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SOME UNITED STATES BIRDS, NEW TO SCIENCE, AND OTHER THINGS ORNITHOLOGICAL.

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[*Based on manuscripts and collections of Lt. C. Bendire, U. S. A.*]

No sooner has the press closed upon the "Key to North American Birds" than I am called upon to add to our fauna two species hitherto unknown to inhabit this country, and believed to be undescribed. But since a new bird * has lately been discovered in Massachusetts, ransacked by ornithologists for half a century, it is not surprising that the comparatively untilled fields of the west should still yield novelties; and we may rest satisfied that North American ornithology will not crystallize till it has simmered for another generation or so. During the year just closed my esteemed correspondent has been diligently collecting near Tucson, Arizona, and has frequently favored me with interesting communications and specimens. Some of his earlier notes have already been published in this Magazine;† and now I have a few more I am equally pleased to offer. Besides the two species of

* *Passerculus princeps* Maynard, Am. Nat. vi, 637.—COUES, Key, 352.

† Relating to the discovery, in the United States, of *Glaucidium ferrugineum*, *Setophaga picta*, and *Tyrannus melancholicus* var. *Couchii*. Also, to the discovery of the nest and eggs of *Helminthophaga Luciæ*, *Harporhynchus crissalis*, and *Pyrocephalus rubineus* var. *Mexicanus*. In a communication dated Dec. 29, 1872, Lt. Bendire informs me of the capture, near Tucson, of *Scardafella squamosa* var. *Yucas*; a dove which, though already introduced to our fauna, has never before, to my knowledge, been taken within the limits of the United States.

birds, most of the nests and eggs to be noticed are new, at least to the public.

The Rufous-winged Sparrow* is a homely little bird, not particularly remarkable for anything I can discover, excepting the bright bay patch on the bend of the wing. It looks at first sight much like a field-sparrow (*Spizella pusilla*), that had curiously enough put on the wings of a bay-winged bunting (*Poœcetes gramineus*); but on sharper scrutiny is seen to be peculiar in other points besides. I suppose it goes in the genus *Peucæa*, and stands next to *P. ruficeps;* though, for that matter, our sparrows are split

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* PEUCÆA CARPALIS *Coues*, n. s. — Upper mandible turgid, its sides visible when the bill is viewed from below, its tomia inflected, the culmen slightly convex, running far on the forehead betwixt prominent antiæ; gonys quite straight. Wings a little shorter than the tail; 2nd to 5th primaries subequal and longest, 1st about equal to 7th; secondaries not surpassing 9th primary. Tail much rounded. Tarsus, measured in front, just shorter than middle toe and claw; lateral toes nearly equal to each other, their claw-tips falling a little short of the base of the middle claw, which the tip of the hind claw, when its digit is bent around, just reaches.

Entire crown rufous, or dull bay, only interrupted by a short pale median stripe on the forehead, and bounded by indistinct pale grayish superciliary stripes. Cervix like the crown, but mixed with gray. Scapulars and interscapulars grayish-brown, mixed with a little bay, and rather sharply streaked with blackish (thus much as in *Spizella socialis*); lower back and rump the same, but lacking the bay and blackish. Whole under parts soiled dull whitish, with faint brownish wash on sides, flanks and crissum, and entirely unmarked, excepting a short, sharp, black maxillary stripe on either side of the chin. All the lesser wing-coverts chestnut, very nearly as conspicuous as in *Poœcetes gramineus;* other coverts, and inner secondaries, with dark brown central field, and pale grayish-fulvous edging. Primaries and tail feathers dull dark brown with slight whitish edging. Bill apparently reddish flesh color, but most of the upper mandible dusky. Feet whitish-brown, the toes rather darker than the tarsus. Length (fresh) 6·00; extent 8·25. Length (dried); about 5·25; wing 2·50; tail 2·75, its graduation ·50; bill along culmen ·40; tarsus ·66; middle toe and claw ·70. (Inches and decimals.)

TYPE. No. 2689, Mus. E. C., since deposited in Mus. S. I.; Tucson, Ariz., Sept. 1872. (*Bendire.*) It is unmarked for sex, and in poor condition, preserved in the flesh with carbolic acid. The plumage likewise is much worn; in better state the colors may be brighter and purer than as described. Very young birds are probably streaked below, as in other young *Peucæa*, *Spizella*, etc.

This species does not resemble any other, with which I am acquainted, sufficiently to require comparison. Doubting lest it might be already described among its Mexican allies, I sent the specimen to the Smithsonian, where it was examined by Prof. Baird and Mr. Ridgway. The species may be instantly recognized by the chestnut flexure of the wing, as in *Poœcetes*, in combination with the particular size and proportions, as above given.

P. S., April 7, 1873.— Better specimens, since received, confirm the above surmise. The under parts are pure white, shaded on the sides and across the breast with clear pale ash, on the flanks and crissum with grayish-brown. The pure white chin is bounded by a sharp black line on either side, above which is another, less conspicuous, from the angle of the mouth. Crown and bend of wing alike rich chestnut. Quills and tail feathers blackish-brown, edged as above said, but tail feathers also slightly white-tipped. Markings of back, as described, sharp and pure. Greater wing coverts blackish, with light fulvous edging and whitish tipping. "Iris brown." Fresh, length 5·75; extent 7·80: ♂; taken Jan. 10, 1873.

into so many "genera" that nobody could sort them out if they were once mixed up; it is only by the peculiar process, known to ornithologists, and others, of calling a spade an agricultural implement, that they are perpetrated and perpetuated. Lt. Bendire says this sparrow is very common where he is, and that it stays there all the year; that he generally finds it in company with the black-throated finch (*Poospiza bilineata*), the habits of the two being much the same, and the nesting quite alike. The rufous-winged sparrow builds in a small mezquite or sage bush, often close to the ground and rarely over four feet from it. The nest is made of fine dry grasses and roots, with slender tops of "sacaton" (rye grass) and sometimes a few horse-hairs; it is quite deep, let down into a fork or crotch. The eggs are said to be almost exactly like those of the following bird, only a trifle larger, and four or five to a clutch, instead of three or four.

The Black-throated Sparrow (*Poospiza bilineata*) is a much prettier, jaunty-looking bird, with a jet black throat and face set off with pure white stripes. It is common on and near our south-western border. I frequently saw it in New Mexico and Arizona, at different seasons, but never found a nest, and do not know who was more fortunate until Lt. Bendire gathered quite a large lot. One of them now lying before me is composed of fine grass-stems mixed with much more of very soft-fibred inner bark of some plant I do not recognize, and lined with a little horse-hair. It is marked "Sept. 14th, 1872;" and I may as well mention here as elsewhere, that the laying season of several Arizona birds besides this one is protracted through September.* A set of eggs, taken August 25, numbers three; size, ·73 × ·58, ·74 × ·58, and ·72 × ·57, respectively. These are perfectly plain, white with a faint bluish cast; but occasionally — Lt. Bendire says about one set in twelve — the eggs are sparsely speckled with reddish. He continues: — "This bird is plentiful about here, and resident. It prefers higher ground, two hundred to five hundred yards from the creek bottom, though seldom further out on the plain. The nest is placed in a small mezquite, thorn or sage bush, seldom over four feet high, often almost on the ground. The clutch is usually three, rarely more. Two if not more broods are raised each season. I found fresh

*The following birds were still laying Sept. 13 — *Campylorhynchus brunneicapillus*, *Poospiza bilineata*, *Pipilo Abertii*, *P. "mesoleucus,"* *Zenœdura Carolinensis* and *Chamæpelia passerina*.

eggs Sept. 3. The usual note is *zib*, *zib*, *zib* and a twitter, something like the sound of a coin spinning on a table."

Abert's Towhee (*Pipilo Abertii*) and the Cañon Towhee (*Pipilo fuscus* of Swainson, not of Cassin: *P. mesoleucus* of Baird; Key, 152) are two large species related to our chewink, but dull colored (grayish, etc.) instead of black, white and chestnut. They inhabit the Colorado valley and its vicinity, though Abert's, at least, seems closely confined to the river itself and its tributaries. Both are abundant, and they live together; Abert's is the bigger, and the eggs are readily distinguished. A clutch of *P. Abertii* eggs containing three, taken September 4th, measure ·95 × ·78; ·94 × ·77; and ·95 × ·77; they are plump eggs, broad for their length, little smaller at one end than at the other. The color is bluish-white, sparsely marked, and chiefly at the larger end (where the markings form a splashed area, not a ring), with dark reddish-brown; some of the markings are very fine speckling, others are short, sharp zigzag lines; the general tone of the markings is very dark, as I have said, but some of the spots are quite light reddish, while others (in the shell, and consequently overlaid with its ground color) are neutral tint. The egg is decidedly peculiar, as compared with that of the other species, and recalls some of the least variegated samples of red-winged blackbird eggs, though still the markings are mostly spots, rather than streaks. — Two eggs of *P. fuscus*, taken Sept. 3, measure ·95 × ·72, and ·95 × ·70: thus being as long as those of *Abertii*, but very noticeably narrower, and more pointed at one end. The ground color is pale bluish; the whole surface is marked — thickly at the large end, where the spots tend to a ring, more sparsely elsewhere — with light brownish-red; a few of the (heaviest) spots are darker brown, and many others are neutral tint, or lavender. The marks range in size from mere points to moderately large spots; still they are all *spots*, none lengthening into lines, as is the case with those of *Abertii*.

The Ground Cuckoo (*Geococcyx Californianus*) is a large species of singular aspect and peculiar ways, noted for its swift-footedness, inhabiting the Southwestern Territories and California, and abundant in Southern Arizona. An egg of this bird that Lt. Bendire sent me, and the first one I remember to have seen, measures 1·55 × 1·25, being thus broadly ellipsoidal; the greatest diameter is near the middle, and hardly any difference in size of the two ends is appreciable. It is plain dull white, and looks something

like an owl's egg. My correspondent has noted, he says, a curious fact: — that several birds lay more eggs toward the close of the season than earlier, and he particularly instances the present species. He never found more than three eggs in April and May clutches; but four, five or six in July and August sets. He thinks it may be accounted for by the greater abundance of food after the midsummer rains.

The Painted Flycatcher (*Setophaga picta*) allied to our common redstart, is a beautiful black, white and carmine species which Lieut. Bendire has the credit of first finding in the United States (Am. Nat. vi, 436; Key, 110). Since last spring, when he secured and forwarded the first specimen, he has seen two others (Sept. 12); they were foraging for insects in a mezquite tree, and seemed to be on their way home to Mexico, from the mountainous part of Arizona, where, it is presumed, they passed the summer breeding.

The nest and breeding habits of the beautiful little Vermilion Flycatcher (*Pyrocephalus rubineus* var. *Mexicanus*) have lately been described in this Magazine by Lt. Bendire himself; but here I wish to notice another nest, since received from him. It was despoiled April 27, 1872. It is a low flat structure, which was saddled close down on a large horizontal fork, as I see by the impression of the boughs. Outside and underneath there are some quite large but light plant stems, two or three inches long; the substance of the nest is an inextricably mixed mass of very slender grass, fluffy inner bark, dried moss, horsehair, and white sewing-thread; the lining is a thick warm bed of large pigeon feathers — I think from the breast of a male Carolina dove. The nest is only about an inch deep, though it measures outside three inches across the brim; were it not for the few sticks, and some of the ragged strips, it might be called exquisitely light and delicate.

Nuttall's Whippoorwill (*Antrostomus Nuttallii*) is a beautiful and interesting species, abundant in many parts of the West, from the Missouri region into Mexico, replacing the common Eastern species (*A. vociferus*). It is smaller than the latter, and somewhat differently colored, with a nearly square instead of much rounded tail. It does not cry "whip'-poor-will" like our species, but drops a syllable, saying "whip'-poor" or "poor'-will" as the fancy of the hearer may interpret. But the most singular circumstance is, that it lays white or creamy-white eggs, entirely

unmarked — a thing before unknown in this genus. The eggs are two in number, laid in a mere shallow depression of the bare ground, usually at the foot of a bush — Lt. Bendire found them so, August 2, 1872. When he informed me of this I could not help thinking there was some mistake about it; but on communicating with Prof. Baird on the subject, he replied: "Nuttall's whippoorwill is unique in the genus for laying white eggs. We have several sets of them, and have established the fact beyond question." This is equally novel and interesting; but how about Dr. Sclater's generalization,* which I adopted without qualification in the Key (p. 180), to the effect that all the *Caprimulginæ* lay colored eggs? I think it is easier to stand corrected in this instance than to disturb the bird's position.

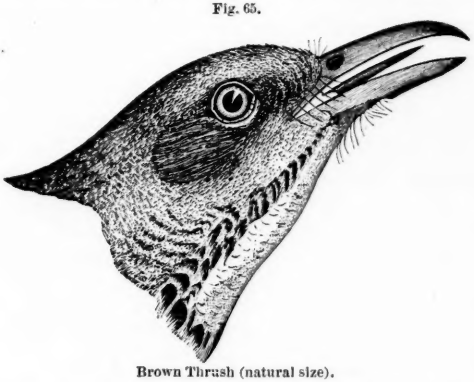
The presence of a sharp horny spur on the shank (tarsus) is a very common character of gallinaceous birds, well illustrated in the case of the barnyard cock; and in some birds of this order there are a pair of spurs, one above the other, on each leg. The turkey gobbler (*Meleagris gallopavo*) is well known to possess a pair, and this is supposed to be a constant character of the males of the genus *Meleagris*. Such, however, proves to be not always the case. "The males do not all have spurs; in fact, I thought at first that the variety of turkey we have in Arizona never had any, and I have been so informed by Mexicans and Indians. But I killed two gobblers myself a few days ago, and both were spurred; though the largest bird I ever killed, a male weighing twenty-eight pounds, had no spurs." (*In epist.*, Dec. 29, 1872).

Almost every one knows the Brown Thrush, or Thrasher (*Harporhynchus rufus*) of the Eastern United States — an abundant and familiar inhabitant of shrubbery, and a spirited songster, with some talent for mimicry. It belongs to the mocking-thrush group (*Mimina*) all of which are famous for their vocal powers; the cat-bird, and the princely mocking-bird itself, are near relatives. The accompanying cut (Fig. 65) looks something like a thrasher in the act of singing. There is a Texan and Mexican variety of this bird, very similar, but longer billed, darker colored, and more heavily streaked underneath. The genus *Harporhynchus* (which means "bow-billed") contains several other species, equally interesting, and seeming to us the more remarkable on account of the extraordinary length and curvature of the bill. All these in-

* Proceedings of the Zoological Society, Feb. 1866, p. 127.

habit our southwestern border; they are much alike in color, differing from our rich foxy-red thrasher very nearly as the homely gray pipilos of the same region differ from the smartly-dressed chewink — being pale dull brownish or grayish, with few or no definite markings, except in one instance. Let us pass them in review, so as to be better able to judge of a certain new species I am going to describe. I will first mention the St. Lucas Thrush (*H. cinereus*); it agrees with the thrasher, and differs from all the rest, in being thickly speckled with brownish-black over most of the under parts. It is dull brownish-gray above; the shape of the bill is shown in figure 70, beyond. We shall have to look at this species again, presently. Next, we have the Californian Mocking-

Fig. 65.

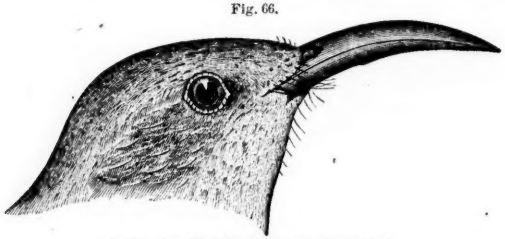


Brown Thrush (natural size).

thrush (*H. redivivus*. Fig. 66). Its points are—the long arcuate bill; dark olive-brown color, paler below, gradually changing to rusty-brown on the belly and to rusty-white on the throat; heavily streaked ear coverts, but no maxillary stripes nor spots on the breast; length eleven inches or more, wing four or less, tail five or more, bill and tarsus, each, about 1⅓ inches. This is the dark California coast form. In the arid Colorado river region, there is a variety of the same bird, identical in size, form and *pattern* of coloration, but extremely pale-colored, as if really bleached with the heat and dryness of the desert. It is apparently very rare; I never saw but two specimens, one of which I was fortunate enough to shoot myself, and only know of two others, which Dr. Cooper secured when he was at Fort Mojave. This is Leconte's

Mocking-thrush (*H. redivivus* var. *Lecontei*); I did not think it necessary to make a drawing of it, because an uncolored cut would show precisely like fig. 66. Next comes the Red-vented, or Crissal Thrush (*H. crissalis*); also inhabiting the Colorado and Gila valleys. It is fully as large as *redivivus* or var. *Lecontei*, with the tail even longer, and the bill, if not larger, at least slenderer and

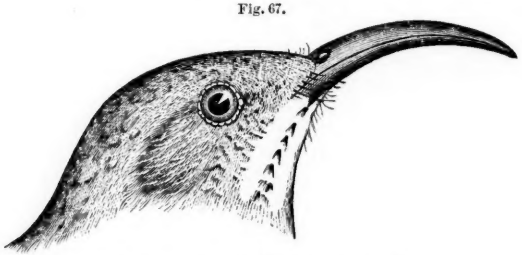
Fig. 66.



Californian Mocking-thrush (natural size).

more arcuate, as shown in fig. 67. Although unspotted, and otherwise colored much like *redivivus*, it is immediately distinguished by having the under tail-coverts rich chestnut (like a cat-bird's — the contrast is quite as great), and by the presence of a sharp, black maxillary line bounding the definitely white throat. Lt. Bendire gave the first good biographical notice of this species

Fig. 67.

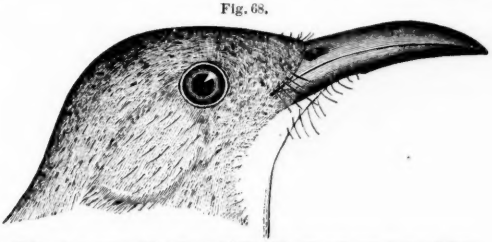


Crissal or Red-vented Mocking-thrush (natural size).

(Am. Nat. vi, 370); the eggs are 1·10 × ·80, large, emerald green, unmarked. Again, we have the Curved-billed Thrush (*H. curvirostris*) in which, notwithstanding its name, the bill is much *less* curved than in either of the last two; the shape is shown in fig. 68. This bird is about as large as *redivivus;* its peculiarities, aside from the bill, are, the duller coloration, pale fulvous under tail-

coverts, no maxillary stripe (no markings whatever about the head excepting some vague speckling on the cheeks), and the underparts obscurely marked with large dark gray spots on a pale gray ground, producing an appearance of clouding or marbling rather than speckling. The true *curvirostris* inhabits Mexico; the Arizona representative constitutes a variety (*Palmeri*. Fig. 68). I

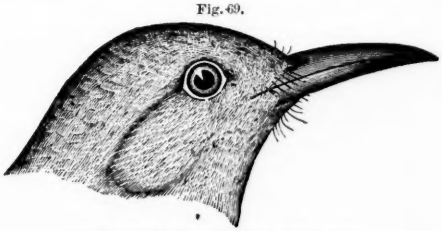
Fig. 68.



Palmer's variety of the Curved-billed Mocking-thrush (natural size).

described it accurately in the Key, p. 351, from Lt. Bendire's specimens, adopting Mr. Ridgway's then unpublished name, "*Palmeri*." Its habits appear to be the same as those of *crissalis;* both birds build in cactus and other low bushes, and their eggs are of the same size. The egg of Palmer's thrush, however, is not like

Fig. 69.



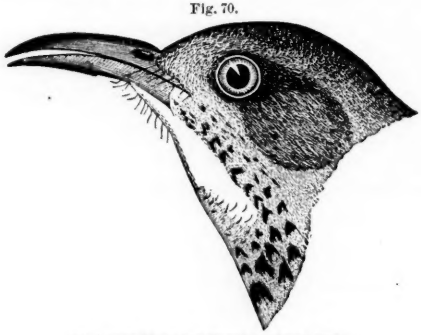
Bendire's Mocking-thrush (natural size).

that of the crissal thrush in color, being dull pale greenish, speckled evenly all over with brownish-red.

Besides all the foregoing, there is another kind of mocking thrush in Arizona, hitherto unknown to naturalists. Soon after I received my first specimens of var. *Palmeri*, Lt. Bendire sent me a bird I could not make out at all; and not having then specially studied these birds, I sent it to Mr. Ridgway, asking him to look over the Smithsonian series and see what it was. He promptly

returned the specimen, saying it was the *female* of his var. *Palmeri*. This puzzled me, for I knew of no such sexual differences in this genus as the specimen presented in comparison with var. *Palmeri;* but presuming, of course, that he knew his own species better than I did, I felt obliged to rest on what he told me, though I was dissatisfied, and in penning p. 351 of the Key, with the specimen before me, refrained from alluding to the (supposed) female of var. *Palmeri*, concluding to await developments. I wrote to Lt. Ben-

Fig. 70.



St. Lucas Mocking-thrush (natural size).

dire, who replied at once that the bird was an entirely distinct species, laying a very different egg, and having somewhat dissimilar habits; and he finally settled the case by sending me a male skin, precisely like the original female specimen, together with several of both sexes of var. *Palmeri*, all alike different from the new bird. A glance at figure 69, as compared with figure 68, will show that Bendire's Thrush,* as it may be appropriately named, has a very

* *Harporhynchus Bendirei* Coues, n. s. (Fig. 69.)—Bill shorter than head, comparatively stout at base, very acute at tip, the culmen quite convex, the gonys however only just appreciably concave. Tarsus a little longer than the middle toe and claw. Primaries:—3d and 4th about equal and longest, 5th and 6th successively slightly shorter, 2d equal to 7th, 1st equal to next to innermost secondary in the closed wing. Tail little longer than the wings, moderately rounded. *Male.* Entire upper parts, including upper surfaces of wings and tail, uniform dull pale grayish-brown, with narrow, faintly rusty edgings of the wing coverts and inner quills, and equally obscure whitish tipping of the tail feathers. No maxillary nor auricular streaking; no markings about the head excepting some slight vague speckling on the cheeks. Under parts brownish-white, palest (nearly white) on the belly and throat, more decidedly rusty-brownish on the sides, flanks and crissum, the breast alone marked with numerous small arrow-head spots of the color of the back. Bill light colored at base below. Length about 9·25 inches; wing 4; tail 4·25, bill (chord of culmen) ·87; bill (along gape) 1·12; tarsus (in front) 1·25; middle toe and claw 1·12. *Female* not distinguishable from the male (the

differently shaped bill; and it is, besides, much smaller, and differently colored. The relationships of the new species are really with the St. Lucas thrush, rather than with Palmer's; for although the markings appear quite different, when we compare the sharp speckling of the under parts of *cinereus* with the faintly spotted breast of *Bendirei*, yet this difference might be produced by climatic influences, just as we have seen in the case of *Lecontei*. The size is the same; and it is the difference in the shape of the bill, in the relative lengths of the tarsus and toes, and in the wing-formula, rather than the coloration, that has caused my present decision, that *H. Bendirei* is not a desert race of *H. cinereus*.

Bendire's thrush is much rarer, in Arizona, than either the crissal or Palmer's. It is resident in the southern portion of the Territory. It builds preferably on trees, sometimes thirty feet high, instead of on bushes. The egg is only ·96 × ·70; its color, grayish-white, with spots and larger blotches, principally about the greater end, of two shades of pale reddish-brown, with some lilac and lavender.

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single specimen is rather smaller (wing 3·75 etc.) and still paler, duller brownish above; but this is owing to worn plumage, if not also, in part, to mummification with carbolic acid).

TYPES: ♂, no. 2687, mus. E. C.; Tucson, Ariz., Nov. 9, 1872. ♀, no. 2688, mus. E. C.; Tucson, Ariz, July 28, 1872. (*Bendire.*)

Allied to, and in some respects intermediate between, *H. curvirostris* var. *Palmeri*, and *H. cinereus*: coming nearest to the latter. Differs from var. *Palmeri* in being much smaller, with much shorter and differently shaped bill, different proportions of tarsus and toes, and markedly different coloration; the upper parts of var. *Palmeri* are a pure dark shade of grayish-brown with a tinge of olive, and the spots of the underparts are large, blended and diffuse, giving a marbled appearance. The average measurements of four specimens of both sexes, of var. *Palmeri*, are:—length 10·75; wing 4·33; tail 5; chord of culmen 1·12: tarsus 1·25; middle toe and claw rather more. In *H. cinereus*, of which a cut is herewith given (fig. 70), the bill, of about the same length as in *Bendirei*, is decidedly more curved; the tarsus is not longer than the middle toe; the 3d to 6th quills are subequal and longest, the 2nd being subequal to the 8th; and the under parts are as distinctly and heavily spotted as in *H. rufus* itself. The size is about as in *Bendirei*, and the coloration of the upper parts is much the same.

THE CONSERVATION AND CORRELATION OF VITAL FORCE.

BY J. T. ROTHROCK, M.D.

It is but lately that physicists have proven to the satisfaction of other men equally learned, that there does exist a series of compensations in the forces of nature; and that heat, light, motion and other powers, more or less unknown, not only may be converted, the one into the other, but that their exact equivalents may be stated in infallible mathematics. This had been dimly foreshadowed long ago, but its final proving belongs to our day. Vital force, however, from its very essence is more intractable, and overrides mathematical restrictions, willing (so far as we can now see) to acknowledge similar relations of the most general character only.

There is no denying that the most sublime mental endowments may in the same individual be associated with the most hopelessly ridiculous, and we are hence prepared to accept as true, or at least as not improbable, that the "greatest, wisest" of mankind could also be the "meanest." Indeed, second thoughts may convince us that surpassing intelligence in one direction, implying unbroken devotion to a given line of study, almost of necessity, entails a corresponding ignorance in other lines of mental activity for which no leisure hours can be found.

But whilst we are foiled in any attempt at estimating the exact amount of vital or purely mental force in excess in one direction, which it will require to compensate for a deficiency in some other, we may nevertheless, with some degree of certainty affirm that such relations do exist.

Geoffroy Saint-Hilaire not only recognizes the existence of this principle of compensation, but has drawn largely upon it in his teratological studies.

De Candolle, after granting the relation between excessive growth and atrophy, states that it is often exceedingly difficult to decide whether the former determines the latter, or the converse.*

* De Candolle, Theor. elem., ed. 1, § 73.

It is, then, with no claim to originality that this is written, but rather to call for the more general recognition of a law already noted by the more observing ones. We may be unable to explain it, or, what is still more damaging to its chances of acceptance, be unable to show how it is to chime in directly with any form of evolution; for to this we have all now come; still it remains a law, as active as any other, even though it be less sharply defined.

If called upon to express what I believe concerning it, I would say: that all organic things, plants or animals, have a certain proportionate amount of developing force, actual or predestined, and that this synergy is under the direction of inherited tendencies; which being at times misdirected, one organ or set of organs may take on excessive growth. Should this occur, there will be a corresponding atrophy in some other organ or set of organs. Now against this statement of what I conceive to be underlying all growth, many instances can be adduced. Still the facts in its favor, when fairly marshalled, seem to me so preponderating as to make them more than mere coincidences.

The scope of this paper allows me to cite but a few out of the many instances I could give. Among plants, take as an illustration *Larrea Mexicana* Moric., the creosote plant of the southwest. It is a representative of the bean-caper family. Inside the base of each filament (which is filiform) is a large two-cleft scale conspicuous enough to attract attention. It is not unusual to find filaments whose bases are not filiform, but are broadly expanded. *Erodium Texanum* Gray is a capital example of this. Besides, this same plant has an outer circle of five stamens which are minus their anthers, a fact which I might turn to account in my argument did space permit.

Now morphology would settle the question concerning the essential nature of the scales of Larrea, by saying that they are the homological equivalents of the stipules we usually find on the right and left sides of the petioles of leaves, and more or less intimately united with them, only in this case instead of being lateral they are intra-petiolar, *i.e.*, between the petiole and the axis of the plant, just as the stipules are occasionally found. To this explanation no exception can be taken, in so far as it goes. But the question still remains unanswered, why it is, when most plants have neither these scales nor the broad bases to their filaments, in the example I have just given, where a decided tendency to cell proliferation

exists, this proliferation should manifest itself in one direction only, *i.e.*, either as scales or broad bases to the filaments, but not both in the same plant?

Gaura, again, furnishes an example of the scales associated with slender filaments, and many more like cases could be brought forward. After some examination I am now unable to find a *distinct, unequivocal contradiction* to the principle I have enunciated. I am not prepared to affirm some do not exist. Indeed I should be surprised if they did not.

The typical anther of our conception is possessed of two cells. Sometimes, however, there is but one, which may often be explained by the partition wall being obliterated, and so causing the confluence of these usually separate cells. In Salvia (sage), however, there is but one cell where two might certainly have been expected. One has gone, entirely, or at most a mere knob of cellular tissue may remain to suggest the missing cell. Interposed between the perfect and the imperfect cells is a connective, unduly elongated, which from its very length and association with the separated halves of the anther serves to explain the want of development in the one. In other words the connective is vigorous and lusty at the expense of the impoverished cell.

Or take that illustration, almost too familiar to be alluded to here, the transformation of the stamens of the wild rose into the petals of the cultivated. It is a simple change of direction given to vital force, but, in so far as I can see, is no superadded power of development. Cultivation may turn the energies of the savage into a new channel, perhaps a higher one in some respects, but it does not follow that it is therefore, because higher in this sense, any indication of greater vitality or force of development. It is simply evidence of a transfer of power, and nothing more.

I have now in my possession an ear of Indian corn on which the grains have failed to develop, the chaff surrounding the grains being on the other hand enormously overgrown. If this instance stood alone I should be willing to admit that the failure of the grains to grow simply allowed room for their envelope to take on so unusual a size. I could, however, were I disposed, cite a long list of cases in which so mechanical an explanation would fail. I will quote a few, freely translated from Moquin-Tandon.

"M. Duval has observed flowers of verbascum, in which the filaments of the stamens took on an unusual growth, and at the

same time lost the usual hairs."* "In certain excessive developments of the parts of the vegetable the hairs abort incompletely, or entirely."† "Mr. Joseph de Caffarelli has given to me a somewhat dwarfed branch of bitter-sweet, which is covered with an enormous number of small hairs."‡ "In *Phleum Boehmeri* the inferior palet of the flower is dilated sometimes beyond measure; the edges then are soldered together at the base; at the same time the superior palet, and the pedicel of the rudimentary flower, abort entirely."§

"I have observed a monstrosity of *Faba vulgaris*, the stipules of which had taken on an enormous increase; they were changed into oval, foliaceous limbs, half arrow-shaped and slightly sinuous; at the same time the limbs of the ordinary leaves had disappeared entirely."‖

"In a monstrosity of *Muscari comosum*, all the flowers had aborted; at the same time the peduncles had become longer."¶

"Lately there has been communicated to the Société d' Agriculture de la Haute-Garonne a spike of corn which presented a curious example of this last balance; all the flowers were found in a normal condition except one, of which the calicinal envelopes had taken on a growth almost double their natural size; the surface of this flower was covered with a thick coat of hairs, and its appearance resembled much that of a flower of the "folle avoine."**

"In some flowers the atrophy of the stamens coincides with the hypertrophy of the pistils. For example, in certain individuals of *Lychhnis dioica* the male organs are found dilated, so that the pistils are represented by small, gland-like bodies; but in the other flowers the female organs are much developed, so that the stamens are reduced to simple rudiments; the same phenomenon occurs in *Spiræa Aruncus*, and in *Sedum Rhodiola*."†† In this last quotation we have plants associating themselves with such as our *Houstonia cærulea* in which, (belonging to hermaphrodite genera) there is a manifest tendency to assume that higher sexual organization where the individual shall be prepotently either male or female, as the one or the other set of organs takes on unusual growth. In other words, it seems to be a good illustration of the principle of vital compensation applied to function as well as to structure.

Mr. Thomas Meehan has furnished us a case directly in point

* Tératologie Végétale. p. 63. † *Idem*, pp. 62 and 63. ‡ *Idem*, p. 68. § *Idem*, p. 157.
‖ *Idem*, p. 156. ¶ *Idem*, p. 156. ** *Idem*, p. 158. †† *Idem*, p. 158.

in *Fragaria vesca* L. I quote him almost verbatim. "When it does not produce stolons, the number of flower spikes is increased, and, as they cannot run as stolons, they make up for this by continual axial production, bearing a succession of flowers through the whole season."

"Sometimes the runner party will so get the upper hand that the pistils will be entirely suppressed, in which case the runners push out with so much enthusiasm as to crowd down and frequently destroy their floriferous neighbors. In fact, just in proportion as the plant becomes truly fruit bearing, and with a tendency to produce a succession of fruit on the same stock, is the tendency to produce runners checked." He then gives a modification of the above, but which is still a case in point.*

The same journal contains a description of a double early saxifrage with a small *panicle*, *double flowers* and *no trace of either stamen or pistil*.†

The animal kingdom would furnish us with still more striking illustrations. A fact I had long suspected concerning hydrocephalic children met lately with a most unexpected confirmation in the distinct, unequivocal testimony of one of the most distinguished living pathologists. "The process of enlargement in these cases is often one of simple growth, and that indeed to a less extent than it may seem at first sight; for it is very rarely that the due thickness of the skull is attained while its bones are engaged in the extension of their superficial area. *Hence the weight of an hydrocephalic skull is not much, if at all, greater than that of a healthy one;* a large parietal bone, measuring nine inches diagonally, weighs only four ounces, while the weight of an ordinary parietal bone is about three ounces."‡

In his admirable text-book on "Diseases of Children," 2d edition, page 298, Dr. J. Lewis Smith under head of "Anencephalic Children," writes:—"The vault of the cranium is absent. There is a deficiency of the frontal, parietal and occipital bones, except those portions which are near the base of the cranium. These portions are very thick and closely united as if there were *the usual amount of* osseous substance, but instead of expanding into the arch, it had collected in an irregular mass at the base of the cranium."

*American Naturalist. August, 1869, pp. 328 and 329. † *Idem*, p. 327.
‡ Surgical Pathology, Paget, pp. 58 and 59. Third English edition.

Quoting again from the same author we are told:—"Hypertrophy of the brain is associated with rachitis, and stunted growth."* Under rachitis, he informs us that, "while in the first and second stages, there is an arrest of ossification and a deficiency of calcareous salts in the system, there is often in the third stage, as Lebert has stated, an exuberance of ossification and a superabundant deposit of the salts of lime, so that the reconstructed bone is stronger and firmer than the normal bone."†

Here then it would seem as though the compensation might extend over different intervals of time, one period being marked by a plus quantity, another by a minus:—a happy illustration of what John Hunter called the "body's memory." For this we are not entirely unprepared. The "stale" condition of overtrained pugilists is as much due, after all (some things lead us to suppose), to an excessive demand on their vitality as to subsequent dissipation; and the early break down of so many of our best college gymnasts is but another fact in the same category. Overdraw your bank deposit at one time and you are left a debtor at another.

Failure of the long bones to properly develop in their longitudinal direction under certain conditions of disease is connected with undue thickening of the same bone.

Turning now to the domain of surgery proper:—it is probable that the vast majority of new growths will be found to occur in advanced age, or at least after the "prime of life." I exclude ovarian tumors for manifest reasons.

So commonly do we find scirrhus tumors of the breast associated with declining years, that age is always made an element of the diagnosis. The testimony of Paget on this point is most explicit. His table of the frequency of cancer at the different periods of life is

Under 10 years	5
Between 10 and 20 years	6·9
" 20 " 30 "	21
" 30 " 40 "	48·5
" 40 " 50 "	100
" 50 " 60 "	113
" 60 " 70 "	107
" 70 " 80 "	126‡

* *Op. Cit.*, p. 374. † *Idem*, pp. 98 and 99. ‡ Third English Edition, p. 798.

thus showing that its frequency is more than twenty-five times as great between seventy and eighty years as at ten years of age.

Does it not seem as though the still unused strength, lacking in these declining years a legitimate employment, were engaging in the development of a low grade of cells whose vitality was insufficient for their own stability? This however is but a poor hypothesis to account for a well proved fact.

Be all this as it may, however, of this there is no doubt:—that after the removal of an *external*, malignant growth at an advanced stage of development, the chances of disease of the same character attacking an internal organ are greatly increased: hence prolongation of life is seldom gained by a surgical operation.*

Mr. John Simon gives an explanation of some of these facts I have derived from medical literature. I quote him, as they possibly may have a wider application. "But besides this antagonism effected through the general circulation, there probably are antagonisms of a local character; and parts which are respectively supplied by different contiguously-rising branches of one arterial trunk seem specially able thus to antagonize each other. For assuming the flow through an arterial trunk to remain the same, one branch, or set of branches can only transmit more blood, if, simultaneously, another branch or set of branches transmit less; and we may well conceive it to be an important function of vasi-motor nerves to provide for the adjustment of this antagonism, by establishing such inter-arterial sympathies that the relative opening of one branch shall determine the relative closure of another."† If not too mechanical and in contravention of vasi-motor function, I would venture to suggest that the relative *closure* of one branch might determine the *opening* of another, by forcing more blood through the latter. This would only account for those instances of the organic balance in which the plus and minus were in organs supplied from the same arterial trunk, *i.e.*, anatomical relatives. On the next page however the same author takes a more comprehensive view of his subject and says:—"Textural excitability perhaps is not so exclusively local but that in this respect also these may be conditions of inter-textural balance; the total excita-

*I am aware of the statistics of Velpeau regarding the removal of cancerous growths, but as they are so greatly at variance with the observation of the mass of surgeons, I do not regard them as invalidating my statements.

†Holmes' Surgery, 2d edition, Vol. i, p. 80.

bility of the body at any given moment being perhaps of fixed amount; so that with regard to excitement, just as with regard to blood-supply, plus in one organ would imply minus in another."*

I am unable to say just what views were entertained on this subject by Geoffroy Saint-Hilaire: — not having access to his writings. Milne-Edwards gives the following clear statement of his own opinion. "The principle of connection of organs regulating the place occupied by each; a tendency to an organic balancement, equipoise, or compensation when the development of an organ acts, as it were, injuriously upon others, as if the amount of vital force were restricted and limited.†"

Finally, I quote the following at second hand from Meckel. It seems almost too strange to be true, but as the authority is above reproach we can only accept it as a fact. Let it be observed that here, however, "this antithesis extends over different children of one and the same mother. A girl had on each extremity a superfluous digit, and one hand of her sister wanted four, being the number of digits which her sister had in excess, reckoning the four extremities together.‡"

These are a few out of the immense mass of similar illustrations I might bring forward in support of my belief in an absolute law at the bottom of these correlations of structure, and may I not add:— often of function?

There are many facts on the other hand, which seem to militate against it. But it appears to me most likely that as we more thoroughly understand the principles of biology, in the same measure will our exceedingly vague ideas on this subject become more determined and absolute:— in fact the evidence must almost of necessity, like that in favor of the theory of gravitation, become of a cumulative character. Any other supposition would imply a belief in the ancient idea of a *lusus naturæ*, which is opposed to the most firmly grounded dogmas of modern science.

Any decided deductions in the way of distinct propositions concerning this law are as yet premature, but the following may find some support in the cases I have already given:—

1st. That organs anatomically or physiologically related tend to compensate among themselves for any aberration of structure or function.

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* *Idem*, p. 81.

† Manual of Zoology. Translated by R. Knox, edited by Blake, edition 1863, p. 200.

‡ Cyclopædia of Anatomy and Physiology, Vol. iv, part 2d. p. 946.

2nd. That an organ over-developed in one direction will be under-developed in some other: *e.g.*, the case of the long bones, already cited.

3rd. That time may be an element in this compensation: *i.e.* in rachitis deficient deposit of bony material may be followed later in the disease by an excessive deposit of it in the same bones.

4th. That the influence of this law may extend from one conception to another, as illustrated by the case related by Meckel.

THE GAME FALCONS OF NEW ENGLAND.
THE PIGEON HAWK.

BY WM. WOOD, M.D.

This daring and spirited little hawk (*Falco columbarius*), which is peculiar to this continent, is found more or less common all over the United States and extends its migrations beyond the limits both north and south. Dr. Richardson says "it is not uncommon in 57° north latitude." Cassin says "it is found both on the Pacific and Atlantic coast and its locality may be stated as the whole of temperate North America." Audubon found them quite abundant in Texas "where he shot five in a short time." I am somewhat at a loss to know what interpretation to put upon the word abundant as used by Audubon. If it is received according to the common acceptation of the word, it is wholly at variance with my experience, and with that of my collectors, and of those with whom I exchange. The fact of shooting five in a short time proves nothing as to its abundance. They may all have belonged to one brood. Allen, in his ornithological notes on the birds of the Great Salt Lake valley, says that "the pigeon hawk and duck hawk were both frequent." This is I think the most that can be said of the abundance of this hawk anywhere. While it is not uncommon in some sections, in others it is very rare. Nuttall says, "It is, I believe, never seen in New England." For many years I believed that he was correct in this assertion, for, having used my gun quite frequently in Vermont, Massachusetts and Connecticut for twenty-three years prior to 1859, I had

never shot a single specimen; and furthermore, from 1847 to 1859, many, and probably most, of the hawks shot in this vicinity were brought to me, as it was known my museum was free to all, and consequently every one was interested to increase the number of specimens and enhance the attractions and value of my cabinet, and during this time not a single specimen of the pigeon hawk was brought to my office, although it was generally known that I was very anxious to obtain one. There were probably fifty or more specimens brought to me that the sportsmen called pigeon hawks, consisting mostly of Cooper's, sparrow, and sharp-shinned hawks, mostly the latter. Dr. Crary, of Hartford, who was several years my senior in collecting, had not shot or received a single specimen from New England prior to this time. With these facts before me I was prepared to endorse the assertion of Nuttall. The habits of some of our birds were not as well understood then as at present. We are now aware that oftentimes there is a lapse of several years between the times of visitation. Thus it has been with the pigeon hawk. In 1859 they were as common as any of our Rapacia. In 1860 they were less common, and since that time I have only occasionally received a specimen — one in 1871 and none the past season. They probably have left again for an indefinite period.

This bird when sitting on a tree so closely resembles a pigeon that it will oftentimes deceive the most expert hunter. One of the specimens brought me was shot for a pigeon, and the mistake was not discovered until the bird was picked up. It is from this striking similarity that I suppose it derives its name. Its flight is very rapid, and the daring spirit that it exhibits is not surpassed by any bird of its size, for it will not only attack birds larger than itself, but it has even been known to seize birds suspended in cages beside the house. When shot at and not wounded it will fly in circles over the head of the sportsman uttering short piercing shrieks. The little corporal hawk of Nuttall, and the *Falco temerarius* of Audubon, are one and the same bird, and are now considered by naturalists the adult of the pigeon hawk. At what age it arrives at adult plumage I am unable to say. It certainly is not the first year, and so far as is known to ornithologists it may take several years. It would seem from the testimony of Cassin to be at least three years. He says, "There are three well defined stages exhibited in a large number of specimens before

me." "Of these the adult is easily distinguished and is very nearly as figured by Audubon under the name of *Falco temerarius*, but of the other two plumages we cannot at present determine which is the more mature." This hawk is called by some the bullet hawk on account of its rapid flight. It is one of the most destructive of our rapacious birds. Says Samuels, "As he strikes his prey he almost always, instead of clutching it as it falls, alights after it has fallen, in the same manner as the great-footed hawk."

There seems to be some doubt about its nesting in New England or New York. Says Dr. Brewer, "I have inquired into the matter for the past forty years, and I have yet to know of the first instance of the nest and eggs of the pigeon hawk having ever been found in any part of Massachusetts. That it may breed in some mountainous and wild region is of course possible, and my inability to trace it is only negative testimony." Says G. A. Boardman of Maine, "I have never found the nest of the pigeon hawk, but have no doubt it breeds here, as I shoot it all summer and winter; it probably nests in some thick trees not easily seen. It is not a very common hawk with us." Says Samuels, "It is not improbable that it breeds in New England, although I do not remember of an authenticated instance." Says DeKay, "It is not uncommon in this state (New York). It does not so far as I have ascertained breed here." I have for thirty-six years used my gun in Vermont, Massachusetts and Connecticut, having resided in each of the above named States. I have followed the valley of the Connecticut river to its mouth — have followed the Green mountain range from Vermont into Connecticut without finding the nest of the pigeon hawk. For the last twenty years I have employed collectors in New England to gather birds and eggs for me, and have not received an egg of this bird. (The same can be said of my collectors in other parts of the United States.) Notwithstanding all this negative testimony I am of the opinion that they nest occasionally in New England; for in 1859 I received six specimens of this bird shot in May, June and August, and it seems improbable that six should remain here through the nesting season and not breed. In May, 1860, a gentleman who resides some five miles distant, informed me that a small hawk came almost every day and carried off a chicken for him — that it never missed, for it went so like lightning that there was no escaping its grasp. He said that

it always came in the same direction from a tract of woods near his house. Thinking from his description that it must be either the sharp-shinned, sparrow, or pigeon hawk, and believing that it must have a nest near, and wishing to obtain the eggs, I drove out. Accompanied by my friend, we carefully searched the woods without finding anything except the nest of the red-shouldered hawk. The next day the same little hawk returned and was shot, and is now in my collection, a beautiful representative of the pigeon hawk. I have no doubt that it had a nest about there, as it was the season for nesting, and it always came from, and went to the same piece of woods and in the same direction. If it had not young, it must have been carrying food to its mate while incubating. If a mere straggler, it would come and go without any definite place of resort. Our inability to find the nest was not strange, as there were some sixty or eighty acres of heavy-timbered oaks and pines in the tract.

There seems to be some diversity of opinion as to where they nest, as well as to the color and number of eggs. Hutchins informs us that it nests in hollow rocks and trees about Hudson's Bay—making its nest of sticks and lining it with feathers, and laying from two to four white eggs marked with red spots, while Audubon says "that in Labrador he found three nests placed on the top branches of the low fir trees, composed of sticks slightly lined with moss and feathers, and that each nest contained five eggs of a dull yellowish brown color thickly clouded with irregular blotches of dull dark reddish brown." He also found another nest with five young in it. Nuttall says "that it chiefly inhabits and rears its young in the southern states." Dr. Brewer says Nuttall is probably mistaken, as "The pigeon hawk is distributed in the breeding season throughout the northern part of North America. It breeds as far to the south as Maine on the Atlantic coast, and California on the Pacific." "In every instance when I have heard of the pigeon hawk as a summer resident south of Maine it has proved to be the sharp-shinned hawk (*Accipiter fuscus*)." And furthermore he says, in alluding to its nesting in hollow trees, "This is a condition in which the nest of the pigeon hawk is never found, and one in which no other hawk than the sparrow hawk is ever found." Dr. Abbott of New Jersey claims to have found a nest with young in it in a hollow sycamore tree near Trenton, in May, 1863, and to have found the nest with eggs on an elm tree in 1865. How are these differ-

ences to be reconciled? Further investigation alone can settle them. The egg in my cabinet was taken in Labrador and is well represented on plate first, figure first of Samuels' Ornithology. Long diameter $1\frac{9}{16}$; short diameter $1\frac{4}{16}$.

As I have only one egg, and as the number of specimens I have seen has been quite limited, I cannot speak authoritatively upon the subject. I will only say that the markings are almost exactly like those of the duck hawk described in my previous article on the game falcons of New England. They look like diminutive duck hawk's eggs.

In this as in all birds of prey, so far as I have investigated the subject, the female is the largest and most powerful bird. Female—length, 12 to 14 inches; alar extent, 24 to 27 inches. Male—length, 10 to 12 inches; alar extent, 23 to 25 inches.

The adult male is seldom taken here, perhaps one in twelve or fifteen specimens. As the description of the three stages of plumage is given so accurately by Mr. Cassin, and corresponds with my observations, I will give each stage as described by him.

Adult male. "Entire upper parts bluish slate color, every feather with a black longitudinal line; forehead and throat white, other under parts pale yellowish or reddish white; every feather with a longitudinal line of brownish black; tibiæ light ferruginous with lines of black. Quills black, tipped with ashy white; tail light bluish ashy, tipped with white and with a subterminal band of black, and with several other transverse narrower bands of black; inner webs nearly white; cere and legs yellow; bill blue.

Younger. Entire upper plumage dusky brown, quite light in some specimens, and with a tinge of ashy; head above with narrow stripes of dark brown and ferruginous, and in some specimens many irregular spots and edgings of the latter color on the other upper parts. Forehead and entire under parts dull white, the latter with longitudinal stripes of light brown; sides and flanks light brown, with pairs of circular spots of white; tibiæ dull white, with dashes of brown; tail pale brown, with about six transverse bands of white, cere and legs greenish yellow.

Young. Upper plumage brownish black, white of the forehead and under parts more deeply tinged with reddish yellow; dark stripes wider than in the preceding; sides and flanks with wide transverse bands of brownish black, and with circular spots of

yellowish white. Quills black; tail brownish black, tipped with white and with about four bands of white; cere and feet greenish yellow."

ON A SECOND EDITION OF THE GEOLOGICAL MAP OF THE WORLD.*

BY JULES MARCOU.

In 1859 I finished the manuscript of a geological map of the earth, which appeared two years after at Winterthur, Switzerland, in eight sheets, on a scale of $\frac{1}{25.000.000}$. The map, prepared by the learned geographer, my friend M. J. M. Ziegler, on Mercator's plan, although defective as regards certain details of execution resulting from my departure from Zurich to Boston, has, however, been received with favor by geologists as filling a desideratum in science. Some reductions and translations, with my consent, have been made in German, French and English.†

I have now just finished the manuscript of a second edition, intended to be placed in the International Exposition of Vienna, in May, 1873.

Not only have I carefully reviewed all the materials used in preparing the first edition; but also profited by numerous and important additions published during the past fourteen years, and have had in my hands a certain number of inedited geological maps and observations, which have been very liberally furnished by geologists who have explored and inhabited different countries remote and difficult of access. Let us pass in review very succinctly the more important of these new materials.

In the Arctic regions several expeditions have enabled us to color geologically a part of the islands of Spitzbergen, of Greenland, and to modify the geological age of the coal deposits of the islands of Disco, Prince Patrick and Bank's Land. M. Nordenskiold

* Read before the Boston Society of Natural History, March 19, 1873.

† From the negligence of Messrs. Oscar Fraas and Henry Woodward, my name has been omitted in the German and English editions of the reductions of my map. M. Fraas has apologized for it in a letter that he has written on the subject, while M. Henry Woodward, without any explanation, has contented himself with simply erasing my name from the block of the French edition which appears in "La Terre", by my friend Elisée Reclus.

has published at Stockholm a "Sketch of the Geology of Spitzbergen," where he recognizes the crystalline rocks, the Palæozoic, Carboniferous, Triassic, Jurassic and Tertiary. But the most unexpected discoveries, in latitudes so high, are those of terrestrial floras, dating at the miocene tertiary epoch, when, according to Professor O. Heer, all the northern polar region was covered with a vegetation analogous to that which to-day exists in the southern part of the temperate region of the northern hemisphere.

The geological survey of the kingdom of Norway directed by Prof. Kjerulf, besides some important modifications in the geographical distribution of rocks of the southern part of this country, has discovered a coal field of great interest from its geographical position, in one of the isles of the group of Loffoden, the island of Andö, as well as its geological age, which dates from the Jurassic epoch, as the coal bed of the coast of Yorkshire.

The great geological map of the entire Austro-Hungarian monarchy, published by M. F. R. von Hauer, has enabled us to rectify and to give more precision to the geology of the Eastern Alps, of Carpathia, of Dalmatia and Hungary. General Helmersen published at St. Petersburg, in 1863, a new edition of the geological map of Russia, based on that of Messrs. Murchison, Verneuil and Keyserling. But the most important modifications have been made in Russian geology by the researches of Messrs. Ludwig, Barbot de Marny, V. de Möller and Wagner, who have demonstrated the existence of an enormous Triassic formation, extending over a considerable extent of country, and which had been confounded and comprised by Sir Roderick Murchison and his collaborators with the Zechstein and Rothliegende, under the improper name of the Permian system. This question of the Russian "Dyas and Trias," raised by me in 1859, has received a definite and entire solution in the sense of my views, in the important work "Dyas" by Dr. H. B. Geinitz, Leipzig, 1862, and in "The Geological Map of the Western Slope of the Ural" by Valérien de Möller, St. Petersburg, 1869.

The geology of Egypt and Palestine has been especially modified by the researches of my friend Dr. Oscar Fraas, who has kindly sent me besides his journey entitled "To the Orient," a manuscript geological map of those regions. The English military expedition to Abyssinia has been of the greatest advantage to geology, and Mr. W. T. Blanford, of the Geological Survey of India, who accom-

panied the expedition, has published a geological map of the route traversed by the English army. For a long time geologists have disagreed as to the age of a great sandstone formation designated generally under the name "Nubian Sandstone," and in the first edition of the "Geological Map of the World," I have referred these sandstones to the New Red Sandstone (Dyas and Trias) by basing my conclusions on the lithology and on a piece of fossil wood found in Egypt, and described by Professor Unger. M. Louis Lartet, jr., after a journey in these regions, believed that he had discovered a complete and exact solution of the age of these sandstones; and in his work entitled "Essay on the Geology of Palestine, Egypt and Arabia," Paris, 1869, as also in a note inserted in the "Bulletin of the Geological Society of France," vol. xxv, p. 490, under the title of "On a Special Formation of Red Sandstones in Africa and Asia" he refers them not only to the Cretaceous formation, but even the horizon of the Gault and of the Glauconian chalk; and on a geological map he shows this formation extending from Lebanon, by Sinai, to the Cataracts of Assouan as far as Karthoum. Mr. Blanford has indicated these Nubian Sandstones, which he has named Adrigat Sandstone, under some fossiliferous limestones containing a Jurassic fauna and which he has named "Antalo Limestone," and he is led to regard the Nubian Sandstones as of the age of the New Red Sandstone (Dyas and Trias). As regards Sinai, two English observers, Messrs. Wilson and Holland have shown in these Nubian Sandstones the presence of some carboniferous fossils, or at least of fossils of the age of the Dyas. Thus the determination of the epoch of the New Red Sandstone for the Nubian Sandstone appears to be confirmed.

The geology of India has continued to be the object of very important researches on the part of Thos. Oldham and his assistants in the geological survey of this vast empire. My friend Mr. Oldham has kindly sent me a manuscript map which modifies greatly the results which I had accepted for the first edition of my map.

In China, we have had some data quite exact on several points, thanks to the researches of Messrs. Kingsmill, the Abbe David, Pumpelly and Bickmore. Professor E. Beyrich has published a work on the Island of Timor, and M. Jules Garnier has given a geological map of New Caledonia.

New Zealand, thanks to the researches of Messrs. Ferdinand Von

Hochstetter, Julius Haast and James Hector, is to-day completely known, and I owe to the kindness of the two last named *savants*, a manuscript geological map of these isles, which has just appeared at Wellington under the title of "Sketch Map of the Geology of New Zealand."

No country has made so much progress in geology during the last twelve years as Australia. The discovery and search for gold have certainly contributed to it, and the different colonies have devoted considerable sums towards sustaining geological surveys and mining statistics. The colony of Victoria especially has shown the example in the construction of a good geological map by Messrs. Selwyn, Brough Smyth, Ulrich, Henry Y. L. Brown, etc. From Tasmania I have received a manuscript map of all of Van Diemen's Land by Mr. Charles Gould, who for several years has directed the Geological Survey. In New South Wales the Rev. W. B. Clarke has given in numerous memoirs some excellent generalities on this part of the Australian Continent; and Mr. R. Daintree has just published a "Sketch Map of the Geology of Queensland" (Quart. Journ. of the Geol. Soc. of London, vol. xxviii, p. 271, 1872.) Finally, during these last two years Mr. Henry Y. L. Brown has made a geological reconnoissance of Western Australia.

Mr. Alfred Grandidier has given in grand outlines the general characters of the island of Madagascar, which appears to have almost nothing in common with South Africa, while it possesses great affinities with the geology of Western Australia, and even of New Zealand. Southern Africa has for several years, and especially since the discovery of the diamond mines, been the object of geological researches, which allow us to trace with considerable exactitude the principal lines of its geognostical constitution. The geological map of the colony of Natal has been published by Mr. C. L. Griesbach, and the great formation of the Karoo Sandstone, analogous to and probably identical with the Nubian Sandstone, has been studied with care by Messrs. G. W. Stow, G. Grey, Atherstone and Evans. Messrs. Jones and Huxley have coördinated and expressed general views on researches made on the same localities; and I owe to the friendship of Professor T. Rupert Jones a manuscript map reviewing all that has been done in this southern portion of the African continent.

In the New World Messrs. Musters and F. de Pourtalès have

discovered a group of extinct volcanoes between the River Gallegos, Cape Virgins and the eastern entrance of Magellan Straits, in Patagonia. Professor Burmeister, Director of the Museo Publico of Buenos Ayres, has sent me a manuscript geological map of the Argentine Republic, and Mr. David Forbes has published a new geological map of a part of Bolivia and Peru, which slightly modifies the most complete and detailed one of the late Alcide d' Orbigny.

In Brazil some great modifications and corrections have been introduced by the researches of Messrs. Hartt, Coutinho, Chandless and Orton, especially in the basin of the Amazons, and on the shore of the Atlantic Ocean. The Devonian and Carboniferous formations have been traced to Mont Ereré and to the first Cataract of the River Tapajos; the Cretaceous formation is found in upper Purus, and the Tertiary formation near Pebas on the River Marañon.

Mr. Charles B. Brown has sent me a manuscript geological map of English Guiana, the geological survey of which he has directed for several years. The same *savant* published several years ago, in collaboration with Mr. J. G. Sawkins, a detailed geological map of Jamaica.

Venezuela and the United States of Columbia, or New Granada, have been explored by Messrs. Rogias, Uricoechea and Dr. Maack, all of whom have very kindly communicated to me their interesting and difficult researches. The republics of San Salvador and of Guatemala have been explored by the late August Dollfus and M. E. de Montserrat, who have given a geological map of them. Finally, Baron F. von Gerolt, for a long time Prussian minister to Mexico, has published in New York a geological map of a part of the vast plateau, principally of volcanic origin, which extends between Puebla, Guerrero, Guanujuato and San Luis Potosi in Mexico.

The United States and the British Provinces of North America have continued to be the object of numerous researches and geological publications. I may signalize especially (1) in Hudson's Bay Territory the explorations of Messrs. J. Hector, Kennicott, Hind, Bell and Richardson; (2) the numerous journeys and studies of Dr. Hayden on the Upper Missouri; (3) the remarkable discoveries of Dr. Newberry in Arizona and New Mexico, of Messrs. C. King, Rémond de Corbineau, H. Engelmann, S. F.

Emmons, Marsh, Cope and Gilbert in California, Nevada, Utah, Wyoming, Colorado and Sonora.

I have preserved the same classification of rocks and the same colors, except for the pliocene formation, which I have taken out of the tertiary formation to place it with the quaternary and modern formations, with which it has more affinities.

TABLE OF COLORS AND EXPLANATION.

Pale Yellow.	Recent. Quaternary. Pliocene.	Modern Rocks.
Yellow.	Miocene. Eocene.	Tertiary Rocks.
Green, Cretaceous. Pale blue, Jurassic.		Secondary Rocks.
Brown Sienna.	Triassic. Dyassic.	New Red Sandstone Rocks.
Sepia.	Coal Measures. Mountain Limestone.	Carboniferous Rocks.
Prussian blue.	Old Red Sandstone. Silurian. Taconic.	Palæozoic Rocks or Grauwacke.

Pink — Crystalline Rocks.

Vermilion — Volcanic Rocks.

The classification of stratified rocks is merely provisional, and it is really accurate but only for the northern temperate zone, and even in that zone it is limited to the basins of the Atlantic Ocean and of the Mediterranean Sea. However, as we go from these limits, and as we arrive in India or on the Missouri and in California, then we encounter difficulties, that have been noticed and treated of quite plainly by most observers, which are obstacles which can not be passed over in silence nor yet avoided. For a stronger reason when we leave the north temperate zone, we find some anomalies and difficulties which, far from tending to be cleared up with time, on the contrary prove more and more the insufficiency of our classifications and the slight value of so-called palæontological laws. Let us cite some summary examples:—

In the Punjab, on the southern side of the Salt Range, near Jabi, Dr. William Waagen has just found some "Goniatites, Ceratites and Ammonites all together in a limestone bed of about one foot and a half in thickness, associated with unmistakable Producti, Athyris, etc." (See: On the Occurrence of Ammonites associated with Ceratites and Goniatites in the Carboniferous deposits of the Salt Range, "Mem. Geol. Surv. of India," vol. ix, art. 4. That is to say that there occur in the same beds, fossil

forms which in Central Europe indicate Carboniferous, Triassic and Jurassic formations.

In the Valley of the Missouri the forms of fossil Brachiopods, which in Europe characterize the Mountain Limestone, such as Producti, Athyris, Spirifer, etc., are found in some beds which contain at the same time some other fossils, of which the forms Allorisma, Solemia, Schizodus and Pleurophorus, indicate in Europe the Dyas (formerly improperly called Permian). Thus several geologists have ignored the existence of the Dyas in Nebraska, in Iowa, and in Illinois, and have sought to substitute for it a formation of passage that they name Dyaso or Permio-Carboniferous.

In California the forms of Tertiary and Cretaceous fossils are mixed together in such a way that some refer some groups of rocks to the Cretaceous formation, while others regard them as of the Tertiary epoch.

In Australia, some beds containing Carboniferous Brachiopods are found placed beneath and even alternately with coal containing a flora regarded in Yorkshire (England) as Jurassic. Finally in New Zealand, the formations called Secondary seem to be entirely obliterated; and it has been necessary to unite some rocks in the same groups under the bizarre name of upper Palæozoic or lower Secondary, ignorant to which of the two to refer them; and of the upper Secondary or lower Tertiary.

These examples show that our classifications and our laws are still imperfect, and also the progress there remains to be made in order to thoroughly know the history of the earth. The attempts at classifications of eruptive and stratified rocks; those, not less numerous, of the relative ages of interruptions in the deposits of stratified rocks; the study of the breaks and dislocations which have taken place on the surface of our planet, and of the relations which may exist between the one and the other, are all premature attempts, and of doubtful value. Having a knowledge, not even very profound, of some localities, theorizers have launched into the midst of generalities the value of which is very debatable even in the interests of geology. But as it is a quality of human nature of always wishing to theorize and to go from the particular to the general, and as we are always fond of simple explanations and *a priori* views, we easily fall into an admiration for all those who seem to unveil and render themselves masters of the secrets of

nature, and who expose them in certain brilliant mathematic laws, enhanced by the attraction of difficulties overcome, and of secrets unveiled. Vain efforts! They are only deceiving mirages. Ten, twenty, thirty years of observation dissipate them, and demonstrate their insufficiency and falsity. It is observation alone. Observe! Always observe! Do not leave a single corner of the globe without the minute observations of travelling and of resident geologists; and then we can generalize, and the mysteries of our planet will be unveiled and systematized in a synthesis, solid, logical with facts, well balanced and truly philosophical.

REVIEWS AND BOOK NOTICES.

GEOLOGY OF MONTANA.* — Full of interest as this volume is to naturalists and geologists, it also forms the most authentic account we have of the youngest of our territories; and as such, with its fully illustrated accounts of the hot springs and geysers of the Yellowstone and its tributaries, the graphic description of the wonders of the Yellowstone lake and falls, and of the Yellowstone National Park, together with the results of Messrs. Lesquereux and Cope's palæontological discoveries, will make the work excellent reading for any one not specially versed in science.

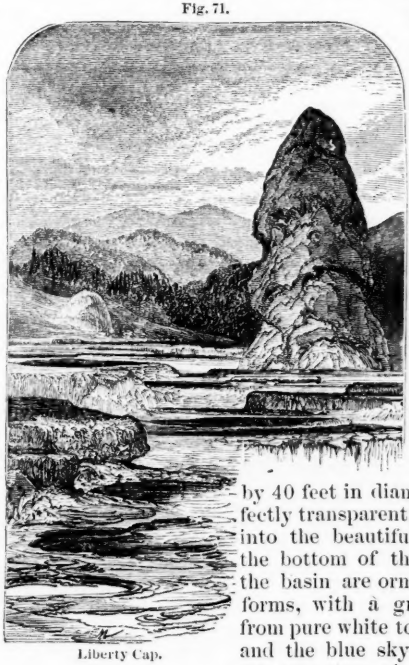
The White Mountain hot springs on Gardiner's River, will first engage our attention. They are not so numerous nor so wonderful as those of the Yellowstone valley or Fire Hole basin, but are much more accessible, and were, at the time the party surveyed them, frequented by a number of invalids, especially those suffering from cutaneous diseases. We quote Prof. Hayden's account.

"We pitched our camp at the foot of the principal mountain, by the side of the stream that contained the aggregated waters of the hot springs above, which, by the time they had reached our camp, were sufficiently cooled for our use. Before us was a hill 200 feet high, composed of the calcareous deposit of the hot springs, with a system of step-like terraces which would defy any description by words. The eye alone could convey any adequate conception to the mind. The steep sides of the hill were ornamented with a

*Preliminary Report of United States Survey of Montana and Portions of Adjacent Territories; being a Fifth Annual Report of Progress. By F. V. Hayden, U. S. Geologist, Washington, 1872, 8vo. pp. 538. With Maps and Illustrations.

series of semicircular basins, with margins varying in height from a few inches to 6 or 8 feet, and so beautifully scalloped and adorned with a kind of bead-work that the beholder stands amazed at this marvel of nature's handiwork. Add to this, a snow-white ground, with every variety of shade, of scarlet, green, and yellow, as brilliant as the brightest of our aniline dyes. The pools or basins are of all sizes, from a few inches to 6 or 8 feet in diameter, and from 2 inches to 2 feet deep. As the water flows from the spring over the mountain side from one basin to another, it loses continually a portion of its heat, and the bather can find any desirable temperature. At the top of the hill there is a broad flat terrace covered more or less with these basins, one hundred and fifty to two hundred yards in diameter, and many of them going to decay. Here we find the largest, finest, and most active spring of the group at the present time. The largest spring is very near the outer margin of the terrace and is 25 by 40 feet in diameter, the water so perfectly transparent that one can look down into the beautiful ultramarine depth to the bottom of the basin. The sides o the basin are ornamented with coral-like forms, with a great variety of shades, from pure white to a bright cream-yellow, and the blue sky reflected in the transparent waters gives an azure tint to the whole which surpasses all art. The calcareous deposit around the rim is also most elegantly ornamented, but, like the icy covering of a pool, extends from the edge toward the centre, and this projects over the basin until it is not more than a fourth of an inch thick. These springs have one or more centres of ebullition, and in this group it is constant, seldom rising more than two to four inches above the surface. From various portions of the rim the water flows out in moderate quantities over the sides of the hill. Whenever it gathers into a channel and flows quite swiftly, basins

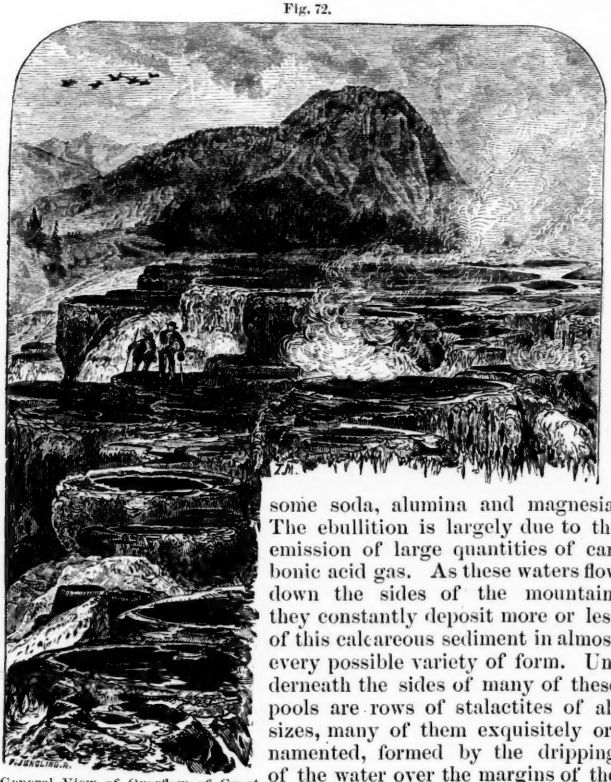
Fig. 71.



Liberty Cap.

with sides from 2 to 8 feet high are formed, with the ornamented designs proportionately coarse, but when the water flows slowly, myriads of the little basins are formed, one below the other, with a kind of irregular system, as it might be called, which constitutes the difference between the works of nature and works of art. The water holds a great amount of lime in solution. It also contains

Fig. 72.



General View of Overflow of Great Spring, Gardiner's River.

some soda, alumina and magnesia. The ebullition is largely due to the emission of large quantities of carbonic acid gas. As these waters flow down the sides of the mountain, they constantly deposit more or less of this calcareous sediment in almost every possible variety of form. Underneath the sides of many of these pools are rows of stalactites of all sizes, many of them exquisitely ornamented, formed by the dripping of the water over the margins of the basins."

"Liberty Cap (Fig. 71) is undoubtedly," says our author, "the remains of an extinct geyser." The water was forced up with considerable power, and probably without intermission, building up its own crater until the pressure beneath was exhausted, and then it gradually closed itself over at

the summit and perished. No water flows from it at the present time." The above figure illustrates this chimney-like extinct geyser, of which large numbers were scattered over the surface "formed by what may be properly called pulsating geysers." Fig. 72 illustrates one of a series of bathing pools which is thus described.

"Between one of the largest oblong mounds and the base of the upper terrace, there is a kind of a valley-like interval, which has once been the centre of much activity, but at the present time there are numerous small jets from which the water is thrown to the height of 2 to 4 feet. But it is to the wonderful variety of exquisitely delicate colors that this picture owes the main part of its attractiveness. The little orifices from which the hot water issues are beautifully enamelled with the porcelain-like lining, and around the edges a layer of sulphur is precipitated. As the water flows along the valley, it lays down in its course a pavement more beautiful and elaborate in its adornment than art has ever yet conceived. The sulphur and the iron, with the green microscopic vegetation, tint the whole with an illumination of which no decoration-painter has ever dreamed. From the sides of the oblong mound, which is here from 30 to 50 feet high, the water has oozed out at different points, forming small groups of the semicircular, step-like basins."

We will then follow our party to the basin of the Yellowstone.

"The area of this basin is about forty miles in length. From the summit of Mount Washburn, a bird's-eye view of the entire basin may be obtained, with the mountains surrounding it on every side without any apparent break in the rim. This basin has been called by some travellers the vast crater of an ancient volcano. It is probable that during the Pliocene period the entire country drained by the sources of the Yellowstone and the Columbia was the scene of as great volcanic activity as that of any portion of the globe. It might be called one vast crater, made up of thousands of smaller volcanic vents and fissures, out of which the fluid interior of the earth, fragments of rock, and volcanic dust were poured in unlimited quantities. Hundreds of the nuclei or cores of these volcanic vents are now remaining, some of them rising to a height of 10,000 to 11,000 feet above the sea. Mounts Doane, Langford, Stevenson, and more than a hundred other peaks may be seen from any high point on either side of the basin, each of which formed a centre of effusion. Indeed, the hot springs and geysers of this region, at the present time, are nothing more than the closing stages of that wonderful period of volcanic action that began in Tertiary times. In other words, they are the escape-pipes or vents for those internal forces which once were so active, but are now continually dying out."

The celebrated Falls of the Yellowstone (Fig. 73) consist of two pitches, one 140 feet, and the other a quarter of a mile below, where the river plunges down a distance of 350 feet, into a cañon whose walls are 1200 to 1500 feet high, and "decorated with the

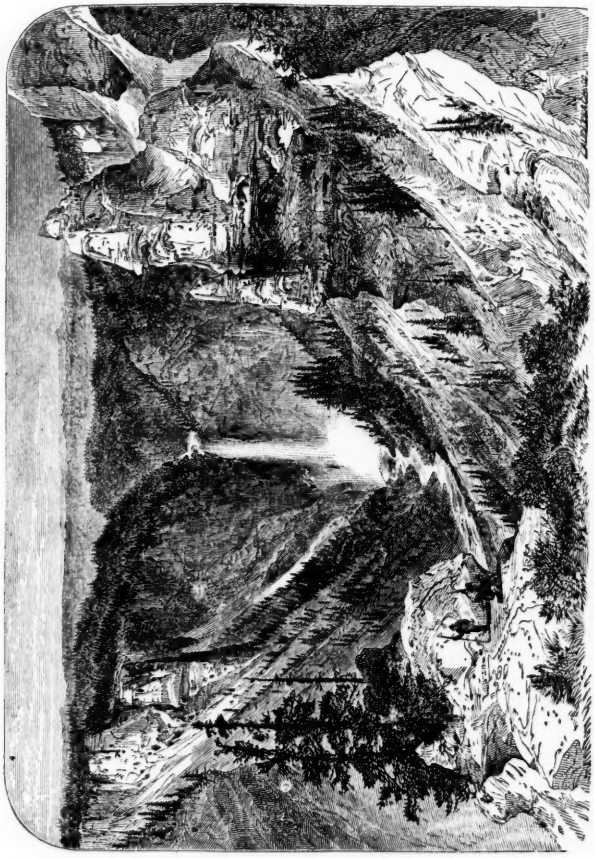


Fig. 73. The Great Canon and Lower Falls of the Yellowstone.

most beautiful colors that the human eye ever saw, with the rocks weathered into an almost unlimited variety of forms." . . . It is a sight far more beautiful, though not so grand or impressive as that of Niagara Falls.

"This entire basin was once the bed of a great lake, of which the lofty range of mountains now surrounding it formed the rim, and the present lake is only a remnant. During the period of the greatest volcanic activity this lake was in existence, though its limits, perhaps, could not now be easily defined; but it was at a later period inclosed within the rim. The basis rock is a very hard, compact basalt, not easily worn away by the elements. The surface is exceedingly irregular, and filling up these irregularities is a greater or less thickness of volcanic breccia and the deposits of hot springs. Upon all this, in some localities, continuing up to the time of the drainage of this lake, were deposited the modern volcanic clays, sands, sandstones, and pudding-stones, which reach an aggregate thickness of 800 to 1,000 feet. Above the Upper Falls the Yellowstone flows over a hard, basaltic bed for sixteen miles from its outlet at the lake; there is then an abrupt transition from the hard basalt to the more yielding breccia, so that the river easily carved out a channel through it; the vertical walls are clearly seen from below the falls, passing diagonally across the rim. The Lower Falls are formed in the same way; the entire mass of the water falls into a circular basin, which has been worn into the hard rock, so that the rebound is one of the magnificent features of the scene. Below the Lower Falls the sides of the cañon show the material of which it is mostly composed. Where the river has cut its channel through the hard basalt, the irregular fissures, which undoubtedly extend down, in some manner, toward the heated interior, are distinctly seen. Local deposits of silica, as white as snow, sometimes 400 or 500 feet in thickness, are seen on both sides of the Yellowstone. These also are worn into columns, which stand out boldly from the nearly vertical sides in a multiplicity of picturesque forms. The basis material of the old hot-spring deposits is silica, originally as white as snow, but very much of it is tinged with every possible shade of color, from the most brilliant scarlet to pink or rose color, from bright sulphur to the most delicate cream. There are portions of the day when these colors seem to be more vivid, and the rugged walls of the cañon stand out more in perspective, so that while the falls fill one with delight and admiration, the Grand Cañon surpasses all the others as the one unique wonder, without a parallel, probably, on our continent. We may conclude, therefore, from the point of view presented above, that while the cañon has somewhat the appearance of a great cleft or cañon, it is simply a channel carved by the river out of predeposited materials, after the drainage of the old lake-basin."

The Yellowstone lake is described in glowing terms. It is 22 miles long from north to south, averaging 10 or 15 miles in width from east to west, with a depth of 300 feet. "It is fed by the snows that fall upon the lofty ranges of mountains that surround

it on every side. The water of the lake has at all seasons nearly the temperature of cold spring-water."

Happily this wonderful basin, or Yellowstone Park, has by Congress been set apart as a National Park, and thus its attractions will remain forever free to all, and we trust safe from injury by curiosity venders *et id omne genus*.

Before leaving Prof. Hayden's report we may call attention to the soda springs at the bend of Bear river, describing them in the words of the report.

"At the bend of Bear river is located the most interesting group of soda springs known on the continent. They occupy an area of about six square miles, though the number is not great. At this time they may be called simply remnants of former greatness. Numerous mounds of dead or dying springs are scattered everywhere, and only a few seem to be in active operation. So far as the manner of building up the calcareous mounds is concerned, it does not differ from that of the hot springs in the Yellowstone valley, and it may be that they were boiling springs at some period in the past. At the present time they are not usually much above the temperature of ordinary spring-water. In one or two instances the active springs were found to be lukewarm. Nearly all the springs were in a constant state of more or less agitation from the bubbles of gas that were ever escaping. In a few cases the water is thrown up 2 to 4 feet. One spring with a basin 10 feet in diameter, with the surface covered over with bubbling points from carbonic acid gas escaping, had a temperature of $61\frac{1}{2}°$; another bubbling spring, 65°. The Bear river cross-cuts a number of the mounds, thus revealing the secret of their structure. The mounds vary from a few feet to twenty or thirty feet high, built up, in the same way as the hot spring cones, by overlapping layers. There are many of these mounds, which show, by the steepness of the sides, the amount of hydrostatic pressure. Many of the chimneys are nearly vertical, with the inner surface coated over with a sort of porcelain."

The second, third and fourth parts of the reports contain valuable contributions from Messrs. Thomas, Lesquereux, Cope, Leidy, Meek, Horn, Uhler, Edwards, Porter and Beaman.

Mr. Lesquereux gives the following summary of his views deduced from the study of our Tertiary and Cretaceous flora.

"1st. The Tertiary flora of North America is, by its types, intimately related to the Cretaceous flora of the same country.

2d. All the essential types of our present arborescent flora are already marked in the Cretaceous of our continent, and become

more distinct and more numerous in the Tertiary; therefore the origin of our actual flora is, like its *facies*, truly North American.

3d. Some types of the North American Tertiary and Cretaceous flora appear already in the same formations of Greenland, Spitzbergen, and Iceland; the derivation of these types is therefore apparently from the arctic regions.

4th. The relation of the North American Tertiary flora with that of the same formation of Europe is marked only for North American types, but does not exist at all for those which are not represented in the living flora of this continent. Therefore the European Tertiary flora partly originates from North American types, either directly from our continent or derived from the arctic regions.

5th. The relation of the Tertiary flora of Greenland and Spitzbergen with ours indicates, at the Tertiary and Cretaceous epochs, land connection of the northern islands with our continent.

6th. The species of plants common to the Cretaceous and Tertiary formations of the arctic regions and of our continent indicate, in the mean temperature influencing geographical distribution of vegetation, a difference, in +, equal to about 5° of latitude for the Tertiary and Cretaceous epochs.

7th. The same kind of observations on the geographical distribution of vegetable species shows at the Tertiary and Cretaceous times differences of temperature according to latitude, analogous to what is remarked at our time by the characters of the southern and northern vegetation."

We quote with much satisfaction the conclusions of so able a palæontologist as Mr. Lesquereux that the European Tertiary flora partly originated from arctic North America. We may be pardoned for referring to our own view expressed in 1865. From a study of the quaternary fossils of Labrador and New England, we ventured on general grounds, though not a botanist, to dissent from the view of Dr. J. D. Hooker, that the flora of northeastern arctic America was essentially Scandinavian in its origin.*

Dr. Horn discourses on the distribution of the Coleoptera collected on the plains of the Rocky Mountains and the mountains of Oregon and Montana. The species, owing to the variation in altitude, temperature, and the food plants, vary in a corresponding ratio. He remarks on this subject as follows:—

"*Eleodes obscura* Say affords a beautiful illustration of the extent to which this divergence may be carried. As a general rule I find, not only in *Eleodes*, but also in many other genera, that the

* Observations on the Glacial Phenomena of Labrador and Maine. Read Oct. 4, 1858. (Memoirs Boston Society of Natural History, 1867.)

higher the elevation or the colder the climate, the rougher and more deeply sculptured is the species. The smoother forms of *E. obscura* may therefore be expected in the southern regions in which it occurs; for example, var. *dispersa* is New Mexican, elytra with scarcely any traces of striæ; var. *obscura*, elytra distinctly sulcate, but not deeply, is from Colorado and Southern Idaho. As we advance to the west the elytra are more deeply sulcate, as in var. *arata*, while var. *sulcipennis*, from nearer the Pacific coast, has deeply sulcate elytra, with very convex interspaces. The same variation of sculpture occurs in *Calosoma luxatum* Say, which starts in Colorado with comparatively smooth elytra, until in Vancouver we find the elytra covered with lines of granular elevations, forming the variety known as *C. pimelioides* Walker. The two extremes of each series above noted appear to differ widely from each other, and to be entitled to rank as distinct species. In the foregoing remarks reference only has been made to variations within specific limits. The same law appears to hold between different species. In the genus *Omus* the most roughly sculptured species occurs in Washington Territory (*O. Dejeanii* Reiche), and the smoothest (*O. lævis* Horn) from near Visalia, California. The object of the preceding remarks is to explain what appears to be a law of variation for our western slope, and thus cause the unnecessary multiplication of species, founded on slight characters, to be avoided.

Species everywhere in our fauna appear to be distributed on lines of country presenting as nearly as possible similar meteorological conditions. Thus many Oregon forms extend southward into California, gradually seeking a higher mountain habitat as the region becomes warmer. Two species illustrate this — *Tragosoma Harrisii* and *Phryganophilus collaris*. Both extend their habitat from Maine to California, following the cooler regions westward from Maine through the Canadas and Red River region, thence northward nearly to Sitka. From the latter point southward to Oregon both occur at the ordinary level, and rising as a more southern region is reached, until at the latitude of Visalia they occur only a short distance below the snow-line, at an altitude of from ten to twelve thousand feet.

From Southern California species have extended along the desert regions bordering the Colorado river to Utah. Two instances are presented in the collection just examined—*Calosoma semilæve* and *Anisodactylus piceus*. Species advancing from the region just cited cannot be expected to cross the Rocky Mountains. Our common *Harpalus caliginosus* extends westward over all obstacles until the base of the Sierra Nevada is reached. It has not yet occurred in California proper."

The volume concludes with important papers on the Hemiptera by Mr. Uhler, and an extended essay on the Orthoptera by Prof. Thomas, illustrated by two plates.

RECENT CONTRIBUTIONS TO AMERICAN GEOGRAPHICAL ORNITHOLOGY. — We have before us several recent papers relating to the avian faunæ of a number of quite widely separated localities. To Messrs. Holden and Aiken we are indebted for "Notes on the Birds of Wyoming and Colorado Territories."* These notes were sent to Dr. T. M. Brewer for his private use, and by him communicated to the Boston Society of Natural History. From his introductory note we learn that Mr. Holden's observations were made "in summer," and Mr. Aiken's "between November 1, 1871, and May, 1872. The exact locality, however, is left in doubt, but we are led to infer from Mr. Holden's remarks which follow, that this gentleman's observations were made chiefly about Sherman "in the immediate vicinity of the Black Hills," near the boundary of Wyoming and Colorado Territories. Mr. Aiken's notes, as partially appears from his memoranda (and as I have learned from private sources), were made in El Paso County, Colorado (most of them near Fountain), some two hundred miles south of Sherman and about two thousand feet less in elevation. The two localities thus differ greatly in climatological and other general features affecting the distribution of species. The whole number of species given in the list is one hundred and forty, of which but twenty-seven are common to the two localities. Only fifteen are mentioned by Mr. Holden that are not noted by Mr. Aiken, while the latter reports ninety-eight that are not given by the former. The whole number mentioned as occurring in the vicinity of Sherman is hence forty-two, while one hundred and fourteen were observed near Fountain. The primary value of faunal lists consists, of course, in the indications they give as to the avian peculiarities of limited districts. It would hence have been far better, doubtless, not to have combined in a single list the notes made at such distant localities, and under such diverse topographical and climatic conditions. These observations, however, as thus given, are extremely interesting and very valuable, having evidently been carefully made. They are, moreover, from localities hitherto scarcely explored; the very imperfect recently published list of the birds of Cheyenne (some forty miles east of Sherman, on the Plains, and nearly two thousand feet lower) and the partial

* Notes on the Birds of Wyoming and Colorado Territories. By C. H. Holden, Jr.; with Additional Memoranda, by C. E. Aiken. Proc. Bost. Soc. Nat. Hist., Vol. XX, pp. 193-210; Dec. 1872. (Read June 5, 1872.)

lists of the birds of South Park and of the region at the base of the mountains between Denver and Colorado City,* being the only special reports relating to the birds of the region embraced within or contiguous to the districts explored by Messrs. Holden and Aiken.

The country about Sherman is one of the most barren and forbidding of any of the inhabited portions of the great central plateau of the continent, and the small number of species observed there by Mr. Holden fairly indicates its poverty, ornithologically considered. On the other hand, the region about Fountain, in the valley of the Upper Arkansas, is in a far milder and more fertile district, and the much larger number of species reported by Mr. Aiken indicates nearly its proportionately greater richness in avian life. Neither of these lists purports to be complete or exhaustive, yet they probably embrace all the more common and characteristic species of the two localities.

The whole number of names given is one hundred and forty-two, but in the foregoing remarks it has been considered safe to regard the *Troglodytes aëdon* of Holden's list and the *T. Parkmani* of Aiken's as identical, both undoubtedly referring to the same race (*T. aëdon*, var. *Parkmani*) of *T. aëdon* and not to two species, even if it be assumed that *T. Parkmani* and *T. aëdon* are specifically distinct. In like manner the *Scolecophagus ferrugineus* of Holden's list has been regarded as *S. cyanocephalus* of Aiken's, since the latter is a common summer resident far to the eastward of Sherman, while *S. ferrugineus* has not been previously reported from points nearer Sherman than Eastern Kansas. I have also learned that *Erismatura Dominica* should read *E. rubida*.

Mr. W. D. Scott has given a "Partial List of the Summer Birds of Kenawha County, West Virginia."† The list is based on "two months of field-work (from the middle of January till the middle of August, 1872)," and embraces eighty-six species. The accompanying notes indicate the relative abundance of the species observed, and embrace occasionally short notices of habits and descriptions of the first or nesting plumage of the young, in cases where such stages had not been previously well described.

The avian fauna of Kenawha County consists of a mixture of

* See Allen's "Ornithological Reconnoissance of Portions of Kansas, Colorado, Wyoming and Utah," Bull. Mus. Com. Zool., Vol. III. pp. 113-183, June, 1872.

† Proc. Bost. Soc. Nat. Hist. Vol. XV, pp. 219-228, Jan. 1873 (Read Oct. 2, 1872).

species more or less distinctive of the Alleghanian and Carolinian faunæ, representatives of the former prevailing in the highlands, and representatives of the latter in the valleys. The capture of a pair of *Dendrœca Dominica* is reported,— a species whose northern limit of distribution has generally been supposed to be the lowlands of the South Atlantic and Gulf States. Mr. Scott calls especial attention to the fact that certain species which range over a wide area in latitude differ appreciably in color at this locality from their representatives from more northern or southern localities, being more intensely colored than those from points to the northward, while they are less so than those found further south. *Thryothorus Ludovicianus* and *Ortyx Virginianus* are cited as strongly marked instances. As a faunal list, the paper affords valuable data concerning the summer distribution of the birds of the Atlantic States.

Mr. T. Martin Trippe has published "Notes on the Birds of Southern Iowa,"* based on "the author's observations during a period of nearly two years in Southern Iowa. . . . One year was spent in the southwestern part of Mahaska County; the other in the northeastern part of Decatur County, the latter point being fifty or sixty miles southwest of the former." Mr. Trippe states that although these localities are so near each other, and similar in their physical features, there are quite marked differences in their avian faunæ. In Mahaska County, for instance, the Warblers are much more abundant than in Decatur County, while several species were met with at the latter or more southern point that were not seen at the other. Among these are *Zonotrichia querula*, *Spizella pallida*, *Vireo Belli* and *Salpinctes obsoletus*, birds whose range is chiefly westward and southward. *Spizella pallida* is properly a bird of the plains, and *Salpinctes obsoletus* has not been previously reported much to the eastward of the Rocky Mountains. Several pages of remarks descriptive of the locality and its faunal peculiarities introduce the list, and add much to the value of the paper.

The list, though not presented as a complete one, is believed by its author to pretty fairly represent the main avian characteristics of the region in question. Of the one hundred and sixty-two species mentioned, ninety-two were observed breeding, or in such numbers during summer as to leave no doubt of their breeding

* Proc. Bost. Soc. Nat. Hist., Vol. XV, pp. 229, March, 1873 (Read Oct. 16, 1872).

there, eighty-five of them being regarded as common. Mr. Trippe calls attention to the fact that all but fifteen of the species he found breeding in abundance in Southern Iowa, breed also abundantly on the Atlantic coast, in the same latitude, nearly fifteen hundred miles to the eastward. This he considers as an astonishingly small difference, considering the great distance between the two points. Although perhaps surprising at first sight, when taken in connection with the fact of the considerable differences in the faunæ of localities separated by only two or three hundred miles in latitude, it finely illustrates certain general laws of geographical distribution, namely, that difference in longitude has *per se*, almost nothing to do with the limitation of habitat, while a slight difference in latitude, being necessarily accompanied by differences of temperature, is a powerful modifying cause. In other words, that species are limited in longitude by climatic and other differences in the conditions of environment resulting from the configuration of the general surface of the country, and not by distance merely. Mr. Trippe's list is accompanied with valuable notes relating to the season of occurrence and relative abundance of the species. — J. A. A.

New Avian Subclass.* — The recent discovery of *Ichthyornis dispar*, and *Apatornis celer*, is one ranking in interest, and importance with that of the *Archæopteryx;* an important gain to palæontology which, as Prof. Marsh observes, "does much to break down the old distinctions between Birds and Reptiles, which the *Archæopteryx* has so materially diminished." With just appreciations of the value of the characters presented, the writer proposes for the birds an order *Ichthyornithes*, and a subclass *Odontornithes*. The vertebræ were amphicœlian, and there were numerous, small, compressed, pointed teeth, distinctly socketed, in both jaws. If Prof. Marsh's surmise, that the *Archæopteryx* likewise had teeth and biconcave vertebræ, should prove true, a question of synonymy with *Saururæ* might arise. In explanation of the improper allocation of *Ichthyornis* (in the Key to North American Birds), among ordinary natatorial types, it should be stated that information of the discovery was received just as the pages were going to press, and in advance of Prof. Marsh's final determinations. — E. C.

* *On a New Subclass of Fossil Birds* (Odontornithes). By O. C. Marsh, "American Journal Science and Arts," v, Feb., 1873 (pub. Jan 21, 1873).

BOTANY.

Coloring and Drying of Natural Flowers.—Mr. Muir gives the following abstract of this paper, by E. Puscher (Dingl. Polyt. J. ccv, 391–2.) The flowers are placed in a glass funnel, which is inverted over a plate containing a few drops of sal ammoniac solution. After a few minutes, most blue violet or bright carmine-colored flowers change to a Schweinfurt green; dark carmine flowers become black, white change to sulphur-yellow. The flowers plunged into fresh water retain their new colors for 2–6 hours, and then lose them. By a somewhat similar treatment with hydrochloric acid, many flowers, especially asters, may be colored a beautiful red, which is lasting after the flowers are carefully dried.

The Influence of Colored Light on Assimilation by Plants.—E. Lommel (Pogg. Ann. cxlv, 442.) (Abstr. by E. Kineb.) enumerates many of the conclusions arrived at by different experimenters on this subject, and considers it a well-ascertained fact that the greatest amount of decomposition is produced by those rays which are absorbed by chlorophyll, and have at the same time a high mechanical intensity. Solid chlorophyll shows the absorption bands ii, iii, and iv, but very much less plainly than a solution of chlorophyll, because the white light which passes between the interstices of the chlorophyll cells usually forms a continuous spectrum over the absorption bands, and so dims or wholly obliterates the paler ones, whilst the band i suffers only a slight diminution in intensity. The theory of the author is supported by the direct experiments of N. J. C. Müller (Bot. Untersuchungen, Heidelb. 1871) and by the following experiment.

Two similar bean-plants were placed in frames, the sides and top of the first of which were composed of a combination of blue cobalt glass and red copper glass, which allowed only the red rays between *A* and *B* to pass through; in the second, a combination of red and violet glass was used, which transmitted only the middle red rays. Both conbinations were so dark that the plants could scarcely be seen from the outside; their power of transmitting heat rays was almost identical. At the end of a week, the first plant was sickly and had not increased in size, whilst the young leaves of the second plant had doubled in size, and it was not to

be distinguished from a similar plant kept in diffused daylight. This experiment shows that the middle red rays above can support the growth of a plant, whilst the outer red rays are unable; and also that assimilation is dependent on the quality of the rays and not on the intensity of the light.

W. Pfeffer (in Pogg. Ann. cxlviii, 86–99) interprets Lommel's experiments as only showing that more growth takes place under the influence of the middle red rays, than under that of the outer red rays.

An abstract of Prof. Draper's interesting experiments in the same field will be given in our next number.

Microscopic Photography of Vegetable Tissues.—Mr. Pedler makes the following synopsis of this sketch, by L. Erkmann. (Zeitsch. Anal. Chem. xi, 395.) The section of the plant or other tissue is to be placed, for a night, in a solution of aniline red, not too concentrated. On washing the tissues with water the non-nitrogenous tissues are left uncolored, whilst the nitrogenous tissues remain colored, there being also a considerable amount of shading. From a negative thus prepared, a positive may be obtained in which the nitrogenous substances are dark and the non-nitrogenous light.

Effect of Coal-gas upon Trees and Shrubs.—A series of experiments was tried in Berlin in order to determine the amount of damage done to the roots of trees and shrubs by gas escaping from pipes through the soil, and thus coming in contact with them. It was found that even so small a quantity as twenty-five cubic feet per diem, distributed in one hundred and forty-four square feet of ground, and at the depth of four feet (that is, through five hundred and seventy-six cubic feet of earth), killed in a short time the rootlets of trees of every kind which came in contact with it, and that this damage was sooner done, the firmer and closer the surface of the ground above. (Ding. polyt. Journ. ccvi, 345, abstr. by W. Smith).

Plants new to Gray's Manual.—Three years ago, Miss Furbish of Brunswick collected at Boothbay, Maine, specimens of *Odontites rubra*. This is a pretty Euphrasioid plant easily distinguished from the White Mountain *Euphratia officinalis*. Last summer the same plant was collected by Prof. Rockwood, at

the same locality. It had been previously detected in Guysborough, Nova Scotia.

Crepis aurantiaca, formerly called *Hieracium aurantiacum*, appears to be naturalized in some places in Saco, Maine. It occurs in grounds adjoining a nursery, where it is associated with *Ajuga reptans*, a labiate plant. Probably both plants were introduced in the material employed in packing foreign trees.

ZOOLOGY.

A Remarkable Monstrosity.— I submit the history, anatomical examination and physiological peculiarities of this case of *lusus naturæ*, as one of especial interest to embryologists.

The subject, or subjects, are a pair of twin pigs united throughout the anterior abdominal, thoracical, cervical and cranial regions, having one umbilicus in common. As they now stand (Fig. 74), taxidermy having been resorted to, to preserve them, to ordinary observers, at first sight, their conjoint bodies present the appearance of two individuals standing face to face, being in juxtaposition above the umbilicus, with arms extended at right angles. Below the inferior point of union both are perfectly normal; above this region the front side * resembles the inferior part of the thorax of a normally formed hog. The back side presents the same thoracic appearance, but above it is seen the top of the head (the region posterior and between the ears in a normally formed hog) with two ears in juxtaposition at their point of junction with the head, situated in the median line, one and one-half inches posteriorly to the ones situated in the normal position.

Fig. 74.

Their external appearance, size, form and color are the same. Both are of the male sex. The head, anteriorly of the conjoint pair of ears, is normal in shape, being but slightly broader in the

*The terms front, back, etc., relate to the organization as a whole, the four posterior legs occupying the inferior position.

region of the normally situated ears than is common to this breed of hogs, the only external departure from normality being in the number of tusks, there being double the usual number. In the left side of the mouth the position of the four tusks is alternate, the anterior superior one being situated between the two in the inferior maxillary. On the right side, those in the inferior are anterior to those in the superior maxillary.

There was one sternum in common, situated on the front side; the ribs of each thorax extending about four lines behind it. On the back side the union was formed by muscular prolongations from the latissimus-dorsi, trapezoid and intercostal muscles.

The right pig had a right lateral curvature of the spine in the superior cervical region; the spine of the other having a double lateral curvature, the superior curve being to the left, in the dorsal region, the inferior one to right in the lumbar region.

The thoracic viscera were transposed at right angles, the right lung of each pig occupying the left side of the thoracic cavity of the other, and the left lungs being situated in the right sides of the respective thoraxes. The anterior trachea was connected with the lung situated in the left side of the right hog, and the lung situated in the right side of the left hog; the posterior trachea exhibiting a like connection with the other lungs. One lung, the one situated in the right side of the left hog, was much larger than the other three, respiration having taken place in it, the other three never having exercised that function.*

There was but one pericardium containing the two hearts.

The oral cavity, anterior to the pharynx presented a normal appearance, with the exception of the tusks, already referred to. The anterior glottis was situated normally. The posterior one was reversed in position, the epiglottis being situated on the posterior side; the œsophageal orifice being situated between the two.

In the abdomen were two livers, that of the right hog being of a pinkish hue; the other of a dark brown appearance. There was but one stomach, the œsophageal orifice being situated in the centre superiorly, the pyloric occupying a position directly opposite. The stomach, when inflated, presented the appearance of a sac, constricted throughout its centre in a vertical direction. The duodenum and jejunum were single; the latter, at its inferior ex-

* The hogs, when found, were lifeless, and were supposed to have been still-born.

tremity was bifurcated, beyond which there were two sets of viscera.

The cranial cavity was divided by a cartilaginous septum which separated the two sets of brains. Each set of spinal nerves entered its division of the cranium through its own *foramen magnum*. The cranial bones were normal in number and appearance save the occipital, which had two openings for the spinal nerve, each side of the median line, and processes for muscular attachment. The optic cavities were imperfectly formed. The eyes were not developed, a bundle of fascia with some nerve substance occupying their place.

The subject having been frozen and refrozen several times before it came into my possession, I was unable to pursue the anatomical investigation of the several structures to the extent that I desired, such processes having destroyed the cranial ganglia and nervous system, the microscope revealing the disorganized structures.

These hogs evidently had their origin in one ovum, with two nuclei or germinal centres situated equidistant from one another, and not from two ova which had become nucleally and anatomically commingled in the course of their development. — T. W. Deering, M. D., *Leavenworth, Kansas.*

Swarming of a Brood of Winged Ants.—On the afternoon of Oct. 6th, at about 4 P. M. we were attracted to a part of the large yard surrounding our home, by a multitude of large sized insects that filled the air, and appeared to be some unusual form of insect life, judging of them from a distance. On closer inspection, these creatures proved to be a brood of red ants (Formica) that had just emerged from their underground home and were now for the first time using their delicate wings. The sky, at the time, was wholly overcast; the wind strong, southeast; thermometer 66° Fahr. Taking a favorable position near the mass, as they slowly crawled from the ground, up the blades of grass and stems of clover and small weeds, we noted, first, that they seemed dazed, without any method in their movements, save an ill-defined impression that they must go somewhere. Again, they were pushed forward, usually, by those coming on, after them, which seemed to add to their confusion. As a brood or colony of insects, their every movement indicated that they were wholly ill at ease.

Once at the end of a blade of grass, they seemed even more puzzled as to what to do. If not followed by a fellow ant, as was usually the case, they would invariably crawl down again to the earth, and sometimes repeat this movement until a new comer followed in the ascent, when the *uncertain* individual would be forced to use his wings. This flight would be inaugurated by a very rapid buzzing of the wings, as though to dry them, or prove their owner's power over them; but which, it is difficult to say. After a short rest, the violent movement of the wings would recommence, and finally losing fear, as it were, the ant would let go his hold upon the blade of grass and rise slowly upwards. It could, in fact, scarcely be called flight. The steady vibration of the wings simply bore them upwards, ten, twenty or thirty feet, until they were caught by a breeze, or by the steadier wind that was moving at an elevation equal to the height of the surrounding pine and spruce trees. So far as we were able to discover, their wings were of the same use to them, in transporting them from their former home, that the "wings" of many seeds are, in scattering them; both are wholly at the mercy of the winds.

Mr. Bates, in describing the habits of the Saüba Ants (*Œcodoma cephalotes*) says,* "The successful *début* of the winged males and females depends likewise on the workers. It is amusing to see the activity and excitement which reign in an ant's nest when the exodus of the winged individuals is taking place. The workers clear the roads of exit, and show the most lively interest in their departure, although it is highly improbable that any of them will return to the same colony. The swarming or exodus of the winged males and females of the Saüba ant takes place in January and February, that is, at the commencement of the rainy season. They come out in the evening in vast numbers, causing quite a commotion in the streets and lanes." We have quoted this passage from Mr. Bates' fascinating book, because of the great similarity and dissimilarity in the movements of the two species at this period of their existence. Remembering, at the time, the above remarks concerning the South American species, we looked carefully for the workers, in this instance, and failed to discover above a dozen wingless ants above ground, and these were plodding about, very indifferent, as it appeared to us, to the fate or welfare of their winged brothers. On digging down a few inches, we

* Naturalist on the River Amazons, Vol. 1, p. 32.

could find but comparatively few individuals in the nest, and could detect no movements on their parts that referred to the exodus of winged individuals, then going on.

On the other hand, the time of day agrees with the remarks of Mr. Bates. When we first noticed them, about 4 P. M. they had probably just commenced their "flight." It continued until nearly seven o'clock P. M., or a considerable time after sundown. The next morning, there was not an individual, winged or wingless, to be seen above ground; the nest itself was comparatively empty; and what few occupants there were seemed to be in a semi-torpid condition. Were they simply resting after the fatigue and excitement of yesterday?

It was not possible for us to calculate what proportion of these winged ants were carried by the wind too far to return to their old home; but certainly a large proportion were caught by the surrounding trees; and we found, on search, some of these crawling down the trunks of the trees, with their wings in a damaged condition. How near the trees must be for them to reach their old home, we should like to learn; and what tells them, "which road to take?" Dr. Duncan states,* "It was formerly supposed that the females which alighted at a great distance from their old nests returned again, but Huber, having great doubts upon this subject, found that some of them after having left the males, fell on to the ground in out-of-the-way places, whence they could not possibly return to the original nest!" We unfortunately did not note the sex of those individuals that we intercepted in their return(?) trip; but we cannot help expressing our belief that, at least, in this case, there was scarcely an appreciable amount of "returning" on the part of those whose exodus we have just described; although so many were caught by the nearer trees and shrubbery. Is it probable that these insects could find their way to a small underground nest, where there was no "travel" in the vicinity, other than the steady departure of individuals, who, like themselves, were terribly bothered with the wings they were carrying about with them?—C. C. ABBOTT.

We have noticed that those females that do not return to the old nest found new ones. In Maine and Massachusetts we have for several successive years noticed the swarming of certain species

* Transformations of Insects, p. 205.

of ants during an unusually warm and sultry day early in September. See also this journal, p. 392.—Eds.

Habits of the Cut Worm. — I venture to send you an item in regard to the common cut worm (*Agrotis* or dart-moth) which is new to me. A friend recently related to me the results of some extended observations which were corroborative of some another friend made not long before. He found that the cut worms would come out of the ground at about nine o'clock in the evening; they did not vary many minutes from that time in all the observations he made. He used to watch them for hours, by the light of a lantern.

Sometimes he would put a tin or wooden box around the plant, just to see what they would do, and then occurred what seemed to me the most singular part of their performance. The worm would crawl towards the plant till it came to the box, then it would follow along the side of the box to find an opening, and if none were found, it would ascend the side of the box — whether of tin or wood—to the very top; reach around in every direction, and, if nothing could be felt, would turn and go back, down the outside of the box (never on the inside), and go into the ground. Sometimes he would bend the leaf of the cabbage plant so that the worm could touch it, when it would instantly take to the plant, follow it down till it came to the root, and then commence its work, *i.e.*, gnaw the stem off, and feed on the central portion of the same. The manner in which the worm feeds upon the grape was observed to be thus:—The worm would come out of the ground at its usual time, ascend the vine till it came to a new shoot, gnaw that off, and fasten itself to the stump of the branch so gnawed, and suck the sap of the vine till it was so full it seemed almost ready to burst, then descend to the ground and bury itself out of sight.—N. Coleman, *Grand Rapids, Michigan.*

Composition of Salmon. — Prof. Sir R. Christison lately communicated to the Royal Society the results of a chemical analysis of clean salmon (*i.e.*, those in good condition) and of the same species when exhausted or "foul." A mean of several trials gave, for the clean salmon, oil 18·53 per cent., nitrogenous matter 19·70 per cent., saline matter 0·88 per cent., water 60·89 per cent.; for the foul salmon, oil 1·25 per cent., nitrogenous matter 17·07 per cent., saline matter 0·88 per cent., water 80·80 per cent.

GEOLOGY.

GLACIAL FOSSILS IN MAINE.—The rocks in that part of Maine, lying along the coast between the Penobscot and Kennebec Rivers, are so folded as to form a series of N. N. E.–S. S. W. ridges with smaller plications between them. As the land rose after the melting of the glaciers, sedimentation seems to have gone on rapidly and animal life to have been abundant, while the water level was yet a hundred or two feet higher than at present. The principal folds of the rock strata then formed low hill ranges capped with glacial detritus, and in the fiords between these were accumulated immense quantities of fine clay (light gray, as derived from light colored gneisses and schists). This is usually separated from the bottom rock by a little more or less stratified gravel. As the clay neared the surface of the water, it became more sandy, of course, and passed occasionally into beds of gravel, particularly where the current was strong. These deposits finally emerged, and their record is now partly obliterated by running streams. The clay is found to contain small branches of silicified wood, and the upper strata contain beach shells.

In the town of Nobleboro, twenty or twenty-five miles from the coast, in the valley of the Damariscotta River (Lincoln Co.), the relations of these strata are well shown by a cutting of the Knox and Lincoln Railroad, which has now, I believe, a station about forty rods southwest of it. Nobleboro village is a mile south. The cut is twenty or thirty rods long through a hillside and is thirty-nine feet deep in the middle. Between the hill (which slopes off to a swamp,) and the station, there is a ledge of striated and water-worn gneiss, rather lower than the railroad grade. In the cut above the grade level are—

7. Soil with grass.
6. Sand and gravel curved over the lower strata parallel to the top of the hill.
5. Pebbly gravel, 2–4 feet from top of hill.
4. Sand and gravel.
3. Gravel and clay merging and alternating.
2. Brown clay sandier and drier than No. 1.
1. Blue clay several feet deep.

No. 1 contained decaying blades of eel grass quite abundantly; and the remains of several kinds of shells which were much decayed and generally mere casts; the first two kinds only have the shell solid. *Buccinum undatum* (two specimens); *Fusus decemcostatus* (8); Pecten (two species; one *P. islandicus*); *Serripes Grœnlandica* (10); numerous specimens of *Mya arenaria* and *Mytilus edulis* (3); *Leda*, a few small decayed valves, possibly of Macoma; also what appeared to be the shell of a small crustacean, not an inch long.

In No. 3, the pebbles were conglomerated with oxide of iron in one place.

No. 5, a loose narrow stratum, evidently deposited in shallow water, held many broken and worn shells of clam, mussel, *Macoma fusca* and *Leda Jacksoni*.

No. 6 seems to mark the emergence of the beds, showing a change in the water courses produced by the elevation of some higher land than at this point, from the water. — PAUL SHERMAN.

ANTHROPOLOGY.

PREHISTORIC CULTURE OF FLAX.— Dr. Oswald Heer, the eminent botanist, and one who has devoted so much attention to the structure and history of fossil plants, publishes an article upon flax and its culture among the ancients, especially the prehistoric races of Europe. His memoir may be summarized as follows: First, flax has been cultivated in Egypt for five thousand years and that it was and is one of the most generally diffused plants of that country. It occupied a similar position in ancient Babylonia, in Palestine, and on the Black Sea. It occurred in Greece during the prehistoric period, and at an early date was carried into Italy, while its cultivation in Spain was probably originated by the Phœnicians and Carthagenians. Second, it is also met with in the oldest Swiss lacustrine villages, while, at the same time no hemp nor fabrics manufactured from wool are there to be found. This is considered a remarkable fact, since the sheep was one of the oldest domestic animals, and was known during the stone period. The impossibility of shearing the fleece by means of stone or bone implements is supposed to have been the reason why woollen fabrics were not used. It is thought probable that the skin, with

its attached wool, was made use of for articles of clothing. Third, the lake dwellers probably received flax from Southern Europe, from which section fresh seeds must have been derived from time to time. The variety cultivated was the small, native, narrow-leaved kind from the coast of the Mediterranean, and not at all that now raised in Europe. It must, therefore, have been cultivated also in Southern Europe, although Dr. Heer could not ascertain among what people and at what age this took place. If this could be ascertained it would be an important point in the determination of the antiquity of the lake dwellers. Fourth, at the time of the empire both summer flax and winter flax were cultivated in Italy, as now, but in what form it was grown in ancient Egypt is not determined. It is thought probable that the narrow-leaved variety was first introduced and after that the Roman, and then the common varieties followed. The common plant has doubtless arisen from the cultivation of the narrow-leaved, while the Roman winter flax and the *Linum ambiguum* constitute the intermediate stages. The original home of the cultivated flax was therefore along the shores of the Mediterranean. The Egyptians had probably cultivated it, and from them its use was doubtless disseminated. It is possible that the wild variety and the winter flax were grown elsewhere at the same time, when the cultivated variety had long since driven them out of use in Egypt.— *Nature.*

"INDIAN NETSINKERS" IN NEW JERSEY. — Both the netsinkers and hammerstones, as described by Mr. Rau, in the March number of the NATURALIST, are exceedingly abundant in many localities in New Jersey. Especially along the banks of the Delaware River, and about the creeks that empty into that river, we have found the "sinkers," literally, by hundreds. They are now so abundant in the bed and about the shores of Watson's Creek, Mercer Co., that we do not pretend to gather them, when collecting unless one of unusual shape or size attracts our attention. The collection from this state, made by the writer, and now in the museum of the Peabody Academy, Salem, Mass., contains many specimens identical in all respects with those figured on page 140 of the present volume of this journal; unless it be, that the majority are somewhat smaller and less heavy than the average of the "Muncy" specimens.

The remarks of Mr. Rau, on the hammerstones found associated with the "sinkers," at Muncy, will only in part apply to this same

class of relics, found in the neighborhood of Trenton, New Jersey. So far as the writer's experience in collecting goes, these hammer-stones are found away from the water, on the sites of villages, and more particularly on the sites of the operations of arrowhead makers. Curiously enough, too, the average weight of these hammer-stones is greater, as we have found them, than the average weight of those found at Muncy, Pennsylvania, by Mr. Rau. Always associated with the ordinary hammerstone, which is that with a depression on either side, for the ends of the thumb and second finger, is a smaller cylindrical hammer, of harder mineral, with nothing to indicate that it is a "relic," other than the well battered ends, which are as well marked in these specimens, as the similar batterings and finger pits are in the typical hammer-stones. — CHARLES C. ABBOTT, M. D.

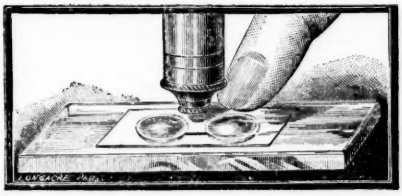
ANTIQUITY OF MAN IN AMERICA. — In the December number of this Journal we made an abstract of a paper printed by the Philadelphia Academy, in which Mr. Berthoud gave an account of the relics of an early race of men. As the geological position of the relics has been questioned, further information is very desirable.

MICROSCOPY.

A NEW SLIDE FOR THE MICROSCOPE.—At a recent meeting of the Optical Section of the Franklin Institute, there was described and exhibited in operation a new adjunct to the microscope, designed by Mr. D. S. Holman, a member of the section, whose life slide recently attracted so much attention and comment. The new device may be called a current cell, or moist chamber, and is designed to afford the microscopist the opportunity of observing and studying the constitution of the blood and other organic fluids with much greater ease and precision than it has heretofore been found possible to attain. The accompanying illustration will serve to make the description of its construction and operation manifest: The slide consists of a plain piece of plate glass of considerable thickness, and three inches by one in dimensions. This is furnished at equal distances from its centre with two well polished shallow cavities of circular form, which are connected with each other by one or more capillary channels. These channels are likewise polished, and to permit of a greater field in

focussing for their contents, the groove of the tube is made triangular in section, with one side forming a right angle with the surface of the slide, and the other forming with it a very large angle. The arrangement of the cell, or moist chamber, is as follows: In order that the current shall be most sensitive, the slide should first be brought nearly to the temperature of the body by holding it for a few minutes in the hand. A small quantity of the liquid to be examined (blood, for example), is then to be placed in each cell, and a thin cover glass placed upon them. If held down for a moment with the hands, the air within the cavities will become slightly rarified, and the cover glass so firmly held in place by atmospheric pressure as to require no artificial attachment. Upon removal of the fingers, it will be found that the centre of the cavities is occupied with a bubble of air, while a thin annulus about the circumference, as well as the connecting capillary tubes, is

Fig. 75.



occupied by the fluid. The slide is now ready for inspection. If placed beneath the microscope, and the instrument is focussed upon the connecting channel, a number of corpuscles, red and white, will be observed, but quite quiescent. Let the finger be now approached to the neighborhood of either cell, when at once a current, more or less rapid, according to its proximity, commences to flow beneath the object glass; remove the finger, and the direction of the current is reversed. The current is caused by the expansion of the air bubble in the cell, in consequence of the heat radiated from the finger; and its rapidity may be controlled to a nicety by regulating the proximity of the finger. So sensitive is the apparatus, that even with the highest powers, a corpuscle, granule or cell in the field of view, may be leisurely turned over and over in any desirable position, thus affording an unequalled means of observation and study to the microscopist; and while the eye is examining at leisure the behavior of the objects beneath it, the

mind is charmed with the simplicity of the means by which these motions are controlled. In the cell here described, no foreign liquid is added to the material under examination. Moreover, if each cell be entirely filled, but with liquids of different densities, the cell holding the denser liquid being placed slightly uppermost upon the rotating stage of the microscope, the action of gravity will cause two currents to flow in opposite directions through the communicating channels, and in this way the phenomena of transfusion, crystallization, etc., may be observed for a considerable length of time, which otherwise are brought to sight only with difficulty. At the conclusion of the description, the ingenious and useful device was highly praised by those members present, who were best able to appreciate its value, and its exhibition beneath the microscope was the occasion of much interest.

Aerial Stage Micrometers.—Dr. Pigott has called the attention of the Royal Microscopical Society to a novel mode of using micrometers. He places the micrometer below the achromatic condenser, and thus employs its image as a stage micrometer, focussing the condenser so as to make the image of the micrometer coincide with the plane of the object on the stage. This remedies the greatest defect of other stage micrometers (as Fraunhofer's), since the accuracy which is necessarily diminished in proportion to the magnifying power employed, is at the same time increased by the whole amplifying power of the achromatic condenser. Hence this arrangement more nearly resembles in accuracy the ocular micrometers, and it might with nearly equal propriety be called an eye-piece micrometer, since its second image is formed in the ocular along with that of the object. It possesses the valuable property of reading off the size of objects directly, without troublesome computation and without allowance for the power of the ocular. Either the cobweb micrometer or the lines ruled on glass may be used, and the arrangement should be such that the micrometer lines should appear on the stage in precisely a definite proportion of their natural size. An accuracy of $\frac{1}{120000}$ of an inch is theoretically quite attainable by this plan. With the cobweb micrometer this arrangement seems nearly faultless, save the first trouble of combining the apparatus so as to get a perfectly accurate reading: but, with lines on glass, the glass plate, with its imperfections as well as its lines, necessarily gives an image which

is perhaps as annoying as if the plate, instead of its image, were in the focus of the eye lens.

THE MICRO-SPECTROSCOPE. — Dr. E. J. Gayer has contrived and published in the Transactions of the Royal Microscopical Society, a micro-spectroscope consisting of a collimating lens and one or more prisms occupying the position of the ocular, and immediately above these a telescope, suitably inclined, for examining the spectra. According to Hogg, and other authorities, the first application of the spectroscope to the microscope was made by Mr. H. C. Sorby who placed a triangular prism below the stage, the object being situated in the spectrum. As this was inapplicable to opaque objects, Mr. Huggins proposed to adapt a direct vision spectroscope to the ocular, which he accomplished by inserting the collimative-tube of a star spectroscope into the body of the microscope in the usual position of the eye-piece. The Sorby-Browning contrivance has so completely superseded these arrangements that they have been nearly forgotton, and Dr. Gayer has rediscovered Mr. Huggins' arrangement without knowing it. He combines with it the Sorby-Browning plan of adding a side stage for the comparison of spectra, and seems to secure an increase of light by placing the slit nearer the objective, about an inch above it. On the other hand, those most familiar with the Sorby-Browning eye-piece form, claim that it has sufficient light and dispersion for its use, and that its absorption bands are not only wide enough but more distinct than if magnified by a telescope.

BLIGHTS ON TEA AND COTTON. — Mr. M. C. Cooke describes a new species of fungus occurring on blighted leaves of the tea plant, from Cachar, India. "*Hendersonia theæcola* Cooke, Perithecia globose, black, prominent, pierced at the apex, scattered over both surfaces, or subgregarious; spores cylindrical, rounded at the ends, triseptate, pale brown, on long hyaline pedicels (.0004–.0005 in.), .01–.0125 millimetres long without the pedicels: on leaves of *Thea*." Picking off the diseased leaves and burning them is the only remedy suggested for this blight, which shares with the punctures of an unknown insect the credit of destroying the plants.

Seeds of American cotton naturalized at Dharwar, India, affected with "Black blight," manifested but little injury externally, but on being crushed were found to be filled with a sooty powder appearing like the spores of an *Ustilago*. On closer examination

Mr. Cooke became satisfied that the spores were originally concatenate, though soon breaking up into subglobose individuals, and he therefore describes them as a new species of *Torula* (*Torula incarcerata* Cooke) notwithstanding their anomalous habitat. As a *Torula* it must be considered a sequence rather than the cause of the decay of the seed, while the opposite would be fairly presumed of an *Ustilago*.

Iridescent Engraving. — Mr. Rutherford of New York, long ago contrived a machine, worked by an electro-magnetic engine, which ruled upon glass microscopical test objects consisting of lines of iridescent fineness; and the beautiful iridescence of Nobert's lines by opaque or dark-field illumination is almost as familiar to microscopists as that of mother-of-pearl or of some of the diatoms.

Recently Mr. Wm. A. Rogers of the Cambridge Observatory has engraved upon glass, lines of great beauty and considerable fineness. Those of medium fineness, especially, glisten beautifully with rainbow-colored light. The lines from $\frac{1}{32}$ inch to $\frac{1}{24000}$ inch, suitable for use in optical instruments as a substitute for spider-web or diamond rulings on glass, are remarkably clear, distinct and uniform in their spacing; while the finer lines excel in fineness and distinctness any engraving previously seen by the writer. Those of $\frac{1}{20000}$ inch are perfectly successful, while those of $\frac{1}{24000}$ inch are capable of being defined and counted. Some of Mr. Rogers' engraving are made in stars like Mr. Stanistreet's lines.

Apertures of Objectives. — The Tolles' $\frac{1}{10}$, sent to London as proof of the utilization of more than 82° aperture in balsam, has been carefully examined by Messrs. C. Brooke, H. Lawson, W. J. Gray and S. J. M'Intire, who report an angle in air of 145°, in water 91°, in balsam 79°. Mr. Wenham believes the balsam angle might have been three degrees higher in hard instead of fluid balsam. Doubtless four more competent judges could not have been selected in the world, and their report will be likely to be generally accepted unless it can be shown that a higher angle might have been utilized at some other point of practically useful adjustment, a question which they can scarcely have failed to consider in preparing the report.

Under-corrected Objectives.—The advantage of these lenses, which have only lately attracted much attention, was distinctly and practically acknowledged by Mr. Wales in the year 1865. At that

time he patented his well known objectives with two backs; one back being calculated to give a result of perfect correction for color, this being required by many microscopists, and being desirable for many kinds of work; and the other back having the lens slightly undercorrected for color, for better performance in photography and in extreme resolution by oblique light. It was, and is, claimed by Mr. Wales that such combinations furnish to microscopists a really valuable choice of qualities and of working power in objectives.

Students' Microscopes. — Since the publication in this Journal of a paper on the above subject, J. W. Queen & Co. have greatly improved their model of students' microscope, availing themselves liberally of the modern suggestions on the subject. They have also introduced, under the name of Popular Microscope, a simplified and cheapened form which seems fully equal to the old style of students' stand. Experienced microscopists will be the first to appreciate the efforts of manufacturers to furnish really good instruments at a price which will render them popular and thereby extensively useful.

A New Ocular Micrometer. — Dr. Pigott advises that the lines of an eye-piece micrometer be engraved on a plano-convex lens of long focus, such as a spectacle glass. As he explains that the convexity is too slight to appreciably alter the effect of the ocular, this form can only excel in ease of obtaining accuracy of workmanship, as compared with the commonly used contrivance of a stage micrometer cut down to such size as to lie in the focus of the eye-lens.

Blood-disks of the Salmon. — Mr. George Gulliver called the attention of the East Kent Natural History Society to the preëminent size among osseous fishes, of red corpuscles of the blood of the salmon family, those of *Salmo fontinalis* having a mean length of $\frac{1}{1455}$ inches and breadth of $\frac{1}{2289}$ inches. On account of this peculiarity of size, "Science Gossip" aptly suggests the choice of this blood to novices in microscopy who desire to study the blood of fishes.

The Highest Power. — Messrs. Powell & Lealand have completed and exhibited a one-eightieth inch objective which has an angular aperture of 160°, works through glass covers .003 thick,

and is fairly up to its nominal power, giving an amplification of 4,000 with the lowest ocular. It is said to give sufficient light and good definition. Its working properties are little known at present.

Red Blood Corpuscles. — Mr. Malassez notices a general tendency of these bodies to diminish in number and increase in size in the lower animals. The following figures indicate the estimated number to a cubic millimetre; in the goat, 18,000,000; in the camel, 10,000,000; in man, 4,000,000; in the porpoise, 3,600,000; in birds, 4,000,000 to 1,600,000; in osseous fishes, 2,000,000 to 700,000, and in cartilaginous fishes, 230,000 to 140,000.

Nature of Markings. — Dr. Pigott believes the spherules of butterflies' scales to be more difficult of resolution than equally separated lines in Nobert's bands. On the other hand, it has been believed that diatom markings were more easily resolved than Nobert's lines of equal fineness; a difference which, if confirmed, might give some hint as to the nature of the various markings.

Microscopic Toys. — Mr. T. Curtiss sent for exhibition at a meeting of the Brighton and Sussex Natural History Society, slides consisting of a variety of figures of flowers, insects and birds, artificially formed of beautifully arranged scales of butterflies and moths. Some of the figures consist of as many as 400 scales, and all were considered wonderfully perfect and beautiful.

The Value of Illumination. — Mr. Hogg stated, at a meeting of the Royal Microscopical Society, that with Wenham's new illuminator he resolved *N. rhomboides* very satisfactorily with a $\frac{1}{4}$ objective made by Andrew Ross twenty-five years ago. Probably this was a $\frac{1}{5}$ by present nomenclature.

A New Society. — A "Medical Microscopical Society" has been organized in London, under the presidency of Mr. J. Hogg.

NOTES.

The daily press has made us familiar with the facts, so far as known, regarding the death of Capt. Hall of the Polaris. His ship penetrated two hundred and sixteen miles (Lat. 82° 16′) farther north than Dr. Kane, or in fact any other vessel. Capt. Parry attained a more northern point by means of sledges. Hall

claimed that Kane's Polar sea is a strait fifteen miles wide. He crossed it in a sledge journey, from which he returned to die aboard his ship.

We are sanguine that the Polaris will be found, and that the scientific results will be commensurate with the care taken in the outfit at Washington and the selection of men to conduct observations. It will be remembered that the chief of the scientific corps is Mr. Emil Bessels, a most promising naturalist, author of several works on the embryology of the invertebrates, and of an unpublished memoir on the embryology of insects. Meanwhile we must wait anxiously, perhaps for three or four months, before knowing of the fate of Bessels and his comrades.

Dr. E. Coues has been attached to the International British Northern Boundary Survey of the 49th parallel, which takes the field on the first of June.

The New Albany, Ind., Society of Natural History is doing good work in developing the natural history of Indiana and has several active workers in its ranks. Located in a rich fossiliferous region, also in the locality of several caves and subterranean streams, we look to the members of this society for important additions to our knowledge in these departments, and we are also pleased to note that they are doing much in collecting the stone and bone relics of the former inhabitants of the region, having already made a large and important collection of specimens, as we can testify from a visit of two years ago. The officers of the society for the following year are—*President*, John Sloan; *Vice Presidents*, Charles Hutchinson and F. L. Morse; *Secretary*, W. W. May; *Treasurer*, J. K. Walts; *Librarian*, Frank Spellman; *Curators*, W. A. Clapp, Wm. Borden, S. L. S. Smith, John Williamson, Wm. Clark.

The Papers on Natural History read at the Washington meeting of the National Academy of Science in April, 1873, were on the following subjects:—Biographical Memoir of Dr. John Torrey, by Dr. Asa Gray; On Reproduction in Progeny of Defects produced by Injury in Parents, by Dr. Charles E. Brown-Sequard; On the Unity of the System of Life in Animals and the true principle of Gradation in the various Animal Types, by Prof. A. Guyot. The following members were elected:—Professor Elias Loomis, Prof. Joseph Lovering, Prof. W. A. Norton, Dr. Theodore Gill, Dr. J. J. Woodward.

We regret that Professors Marsh and Cope have considered it necessary to carry their controversy to the extent that they have. Wishing to maintain the perfect independence of the Naturalist in all matters involving scientific criticism, we have allowed both parties to have their full say, but feeling that now the controversy between the authors in question has come to be a personal one and that the Naturalist is not called upon to devote further space to its consideration, the continuance of the subject will be allowed only in the form of an appendix at the expense of the author.

BOOKS RECEIVED.

Preliminary Descriptions of Three New Species of Cetacea from the Coast of California. (From Proc. Cal. Acad. Sci.) By W. H Dall. Jan. 29, 1873. 8vo, pp. 2.

Ninth Biennial Report of the Superintendent of Public Instruction of the State of Illinois. By Newton Bateman. 8vo, pp. 231. 1871-1872.

Principles de Biologie appliques a la Medicine. By Ch. Girard. 12mo, pp. 108. Paris, 1872.

Schriften des Vereins zur Verbreitung naturwissenschaftlicher Kenntnisse in Wien. 12mo, pp. 415. With 2 woodcuts. Band xii. Jahrgang, 1871-2. Wien, 1872.

Bulletin de l'Institut National Genevois. 8vo. No. 36. Vol. xvii, pp. 1-216, with map. Geneve, 1872.

Bulletin Mensuel de la Societe d'Acclimatation. 8vo. Second Series. Tome ix. No. 11. November, 1872. Paris.

Bulletin Entomologischer Zeitschrift. 8vo. Jahrgang 16. Parts 2-4. With 3 plates. Berlin, 1872.

Memoires de la Societe de Physique d'Histoire Naturelle de Geneve. 4to. Tome xxi. Second Part. With 20 plates. Paris, 1872.

The Half-yearly Abstract of the Medical Sciences. Vol. lvi. January, 1873. Philadelphia.

Chart of Geological Nomenclature intended to express the relation of Minnesota to the great Geological Series of the Earth, and the probable equivalency of some of the names the formations have received in the various States and in Europe. By N. H. Winchell.

On the Glacial and Champlain Eras in New England. 8vo, pp. 16. (From the Am. Jour. Sci. and Arts, Vol. v, Mch., 1873.) By James D. Dana.

Transactions of the Eclectic Medical Society of the State of New York for the year 1871. 8vo, pp. 365. Albany, 1871.

Notes on the Avi-fauna of the Aleutian Islands from Unalashka eastward. By W. H. Dall. 8vo pp. 11. (From Proc. Cal. Acad. Sci.) San Francisco, 1873.

Proceedings of the Royal Society. Vol. xx. Nos. 130-137. 8 pamphs., 8vo. London, 1871-72.

List of Members of the Royal Society. 4to, pp. 31. London, Nov. 30, 1871.

Philosophical Transactions of the Royal Society of London. 4to. Vol. clxi. Part 2. 1871. Vol. clxii. Part 1. 1872. London.

The Depths of the Sea. By C. Wyville Thompson. 8vo, pp. 527. *Illustrated.* Macmillan & Co. New York and London. 1873.

The Relations of Botany to Agriculture. By William S. Clark. 8vo, pp. 29. Boston, 1873.

List of Coleoptera in the Collection of George Dimmock, No. 679 State Street, Springfield, Mass. 8vo, pp. 39. Springfield, 1873.

The Entomologist's Monthly Magazine. London, Feb., Mch., Apl., May, 1873.

The Scottish Naturalist. Perth, Jan., 1873.

Grevillea. London, January - May, 1873.

Feuille des Jeunes Naturalistes. Paris, Feb. 1, 1873.

The Lens. Chicago, January, April, 1873.

Nature. London, Jan. 30 - May 8, 1873.

Science Gossip. London, Feb., Mch., 1873.

The Field. London, Feb. 1 - May 10, 1873.

The Popular Science Monthly. New York, March - June, 1873.

The Canadian Entomologist. London. Vol. v. January, March, 1873.

Land and Water. London, Feb. 8 - May 10.

American Journal of Science and Arts. New Haven, March - May, 1873.

Revue Scientifique. Paris, Feb. 8 - May 10.

Journal of Botany. London, Feb. - May, 1873.

The Academy. London, Feb. 15 - May 1, 1873.

Journal of the Franklin Institute. Philadelphia, March - May, 1873.

Essex Institute Bulletin. Salem. Vol. iv. Nos. 9, 10, 11, 12, 1872; 1 and 2, 1873.

The Canadian Naturalist and Quarterly Journal of Science. Montreal. Vol. vii, No. 1.

Le Naturaliste Canadien. Quebec. March, April, May, 1873.

Bulletin of the Torrey Botanical Club. New York. March, April, 1873.

American Journal of Medical Sciences. Philadelphia. April, 1873.

Quarterly Journal of Microscopical Science. London. January, April, 1873.

Proceedings of the California Academy of Sciences. San Francisco. Vol. iv, Part 5.

Bulletin of the Buffalo Society of Natural Sciences. Buffalo. Vol. i, No. 1, 1873.

Proceedings Academy Natural Sciences. Philadelphia. Part 1. 1873.

Transactions of the American Entomological Society. Philadelphia. Vol. iv. Nos. 1-3.

The Geological Magazine or Monthly Journal of Geology. London. Nov., 1872 - May, 1873.

Journal of the Quekett Microscopical Club. London, Oct., 1872, Jan., Apr., 1873.

APPENDIX

TO

THE AMERICAN NATURALIST,

JUNE, 1873.

REPLY TO PROFESSOR COPE'S EXPLANATION.

BY O. C. MARSH.

The May Naturalist (p. 290) contains Professor Cope's long promised "explanation" of the many errors and false dates in his recent publications, and a most remarkable document this explanation is. As a sleight-of-hand performance with names and dates, it shows practice, and is amusing; but to those familiar with the subject, and to moralists, it suggests sad reflections.

What was fairly demanded of Prof. Cope under the circumstances was:

1st. An acknowledgment, or a full correction, of his numerous mistakes in regard to the *Dinocerata*.

2d. Some definite proof of the publication of his late papers at the dates claimed.

3d. An explanation of the antedating of seven of these papers in the "Proceedings of the American Philosophical Society."

4th. A prompt retraction, and satisfactory explanation, of his false report in "Nature" of this Society's meetings.

Instead of this, Prof. Cope has merely given a tangled web of misstatements and misrepresentations, which can mislead no one who will carefully compare them with the facts, or even with this author's previous statements. In his whole explanation there is not a straight-forward answer to a single point I have made against his work; the important facts in each case being either suppressed, or so twisted as to mitigate the force of my criticism. In the numerous cases where no answer appeared possible, he has quietly dismissed the charges as "frivolous" or "insignificant." To expose this plausible system of defence is an easy task, requiring

plain language, perhaps, but neither loss of temper, nor a dictionary of Latin quotations.

I.

First, as to Prof. Cope's *Dinocerata* blunders. I have pointed out some forty of these in four separate papers. In his explanation, however, Prof. Cope replies to only one of these papers, thus at the outset coolly ignoring three-fourths of his own errors. The paper chosen for reply, moreover, is one that probably few readers of the NATURALIST have seen, and its selection, rather than those in this journal (pp. 146 and 217), well illustrates the characteristic feature in this defence.

Quoting from my article in the "American Journal of Science" (v, p. 117) Prof. Cope refers, 1st, to my correction of his blunder in mistaking canines for incisors, and asserts that he "had determined and stated them to be canines before the appearance of this criticism." Prof. Cope here deliberately suppresses the most important facts, viz :—that I first corrected this blunder at the meeting of the American Philosophical Society, December 20th, 1872, in his presence,* and again subsequently in this journal, vol. vii, p. 52, a month earlier than the paper he cites.

2d. To my criticism, that "The stout horns he described are not on the frontals, but on the maxillaries," Prof. Cope replies with his characteristic tactics. My statement was based on his description of *Tinoceras grandis* Marsh (= *Eobasileus cornutus* Cope = *Lefalophodon dicornutus* Cope = *Loxolophodon cornutus* Cope) and a reference to the figures of this species accompanying Prof. Cope's article proves my assertion beyond question.

3d. The correctness of my statement as to the position of the orbit in the *Dinocerata* is likewise fully proven by the above figures, and those of *Dinoceras*.

4th. The oblique position of the occiput also is fully established by the same illustrations. Prof. Cope has again suppressed an important fact, viz. :— my statement that, in the *Dinocerata*, the head when in its natural position was declined.† I first pointed the character out, and yet Prof. Cope now insinuates that I did not know it!

5th. The temporal fossa is not small posteriorly, but unusually large, and neither this character, nor Prof. Cope's blunder in stating otherwise, was frivolous.

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*Proceedings, Vol. xii, p. 579. †American Journal of Science, v, p. 296.

6th. Prof. Cope states that the great trochanter of the femur "is flat, as in the Elephants." It is not flat in the *Dinocerata*, nor in the Elephants.

7th. The spine of the tibia is wanting, as I have stated, and this "frivolous" point Prof. Cope has since regarded as an ordinal character.

8th. Prof. Cope admits that he mistook the posterior horn-cores for nasal bones, and naturally is vexed to have his blunder pointed out.

9th. That the extremities of the nasals are not excavated, the photographs of Prof. Cope's type specimen clearly show. These photographs prove also that the malar bone is of the true Perissodactyl type. They fail to show the proboscis on which Prof. Cope relies for his most important ordinal character!

Prof. Cope's statement (p. 298) that I based a generic distinction on a small tubercle on one of the molars of *Uintatherium* is only another instance of his deliberate inaccuracy, and is at once disproved by my descriptions (Am. Jour. Sci., v, p. 408).

Prof. Cope's figures are too indistinct, and differ too much from the specimens, for any great dependence to be placed upon them. On comparing them with the photographs from which they were taken, however, the denial of Prof. Cope (p. 315) that he had reversed the tusks is at once shown to be untrue. The inner face of the canine, with its enamel worn away by attrition, is plainly to be seen on the outside as now placed, and to deny this is an insult to every anatomist who has seen the specimen or photographs. In several other points these plates are incorrect, and to get on his problematic posterior horn-cores Prof. Cope has here removed a considerable portion of the lateral crests.

Another good illustration of Prof. Cope's method of reply is seen in his reference (p. 292) to the date of my communication before the American Philosophical Society. The facts are as follows: In a paper on the *Dinocerata*, which purports to have been "published January 16, 1873," Prof. Cope, not merely antedated his own papers, but changed the date of my communication on the subject from December 20th to December 30th, 1872. This error I promptly corrected in the "American Journal of Science" (v, p. 122). When Prof. Cope's paper appeared in the "Proceedings of the Philadelphia Academy" (1873, p. 11) the date was rectified, and now he refers to the emended paper tri-

umphantly, conveying the impression that my criticism on this point had no foundation! No better evidence of the justice of my strictures could be given than the means Prof. Cope has taken to answer them.

Prof. Cope again refers to the affinities of the *Dinocerata* as though he had settled the question. The value of his opinion on the subject may be readily estimated from the fact that in describing the single skull which he figures in his paper, he mistook canines for incisors; nasals for frontals; maxillaries for premaxillaries; maxillaries for nasals; and maxillaries for frontals! His remarks on the Classification of Mammals, likewise, will afford as much amusement to those familiar with the subject, as did his recent attempt to make Cuvier share one of his own most stupid blunders.*

Prof. Cope's defence of his claimed discovery of cretaceous coal in Wyoming lacks both candor and accuracy. Cretaceous coal was well known in this region before Prof. Cope ever saw Wyoming. In his paper on the subject he ignores this fact, and also my discovery of Dinosaurian remains with coal in the same basin, two years before (Am. Jour. of Sci., Vol. i, p. 195). When corrected on this point he boldly asserts that my locality was from one hundred and fifty to two hundred miles distant, when in fact it is less than seventy miles! And yet Prof. Cope charges his critic with being ignorant of the geography of this region!

II.

Having shown that Prof. Cope's attempts to explain away a single one of his blunders about the *Dinocerata* have resulted in failure, it remains to consider next the date of his late papers on Wyoming fossils. I have asserted (p. 151) 1st. That the dates assigned to the advance copies of these papers are not those of actual publication; 2nd. That as finally published in the "Proceedings of the American Philosophical Society," seven of these papers are antedated. Both of these statements are strictly true. It will be observed that the two charges are quite distinct, and do not necessarily have any connection with each other. The former relates to the distribution of advance copies of the papers in question; the latter to the dates in the "Proceedings of the Philosophical Society." Prof. Cope has greatly confused the question

*Proc. Phila. Acad., 1873, p. 12.

by putting the two together, but truth can best be reached by separate consideration of them.

Prof. Cope attempts to gain an important advantage at the start by assuming that mere printing is publication. This he has no right to do, as the usage of the best naturalists is decidedly against it. In the note from which he quotes, I assumed that publication of scientific results means *making them known*, especially to those interested, and in the case of advance copies, these must be made accessible to those working in the same department. Judged by this well established standard, not one of Prof. Cope's papers was published at the date claimed. The mere printing of these papers has no more to do with their publication than has the invention of the printing press. Both events preceded this publication, but neither of them constitute it.

Prof. Cope first brings forward a certificate from his printers. With these gentlemen I have no controversy, but only commendation for their well-meant, but vain attempt to aid Prof. Cope in his present extremity. The document they have signed bears internal evidence of having been written by Prof. Cope himself, as it contains two erroneous quotations, several false inferences, and is so ambiguously worded that it is impossible to tell what it really means. These gentlemen kindly but thoughtlessly signed this certificate for Prof. Cope, precisely as they kindly but thoughtlessly printed at the head of his papers, "Read before the American Philosophical Society, etc.," when a single inquiry would have shown that not one of them had been read, or even presented to this Society.

The only point worthy of consideration in this certificate is the statement relating to the time of delivery of the extra copies, and here disinterested testimony becomes important. To ascertain the exact truth about this delivery, Professor Lesley, Secretary of the American Philosophical Society, applied to the same printers, and in a recent letter, which I retain, he gives the result of his inquiries as follows:—

"Stavely & McCalla inform me that in every case Cope's extras were not delayed more than twenty-four hours, and sometimes were sent to King on the very day of the printed date at the foot of the page."

This is a very different statement from the certificate which Prof. Cope induced these accommodating gentlemen to sign, and it proves conclusively that the papers in question were not usually delivered

on the day of printing, and hence could not have been published at the dates claimed. This is an essential point, as a single day decides priority in some of the most important cases, and to gain this day Prof. Cope has mainly directed his serpentine efforts.

The other two certificates which Prof. Cope's friends have signed have little bearing on the present question, as they give no definite information as to the real point at issue. The one signed by Mr. King, however, proves that Prof. Cope himself is responsible for withholding his papers from all naturalists working in the same department, as he prepared the list of addresses. Any weight this certificate might otherwise have had is materially diminished by the fact that the list of papers given does not include some of the most important in the series Prof. Cope claims to have published.

The third certificate, as it now stands, carries no authority. It shows the same parentage as certificate No. 1, and is equally ambiguous; but, being shorter, it contains only one false quotation and less misrepresentation. It refers to the "above papers," but gives no indication of what papers Prof. Cope mentioned in distributing this circular, and has nothing to show that the list was the same in each instance. If this really was the case, it is a marked exception to the other points in Prof. Cope's explanation.

The quotation in this circular affords a good example of Prof. Cope's jugglery with words, when he finds the facts against him. He has not merely misquoted, but he has entirely changed the meaning of the sentence by applying it to his extra papers, and not to the dates in the "Proceedings," as it stood in my note.

Taking these three certificates together, there is nothing in them that proves any single one of the doubtful papers to have been published as claimed. The note on *Loxolophodon*, e. g., to which Prof. Cope now gives the date of Aug. 19, 1872, did not have this date on it when printed, and some of the other papers had no dates whatever. One lot, at least, remained at the rooms of the Philosophical Society over a month, after printing, before any of them were distributed. To claim publication under such circumstances is an outrage, which should be resented by every naturalist.

The only evidence of any weight about distribution is where the date of receipt of each individual paper is noted at the time. Such record was kept by the editors of the NATURALIST;* by the editors

* See Book Notices in Vol. vi, where my papers are duly recorded.

of the "American Journal of Science;" by Prof. Baird of the Smithsonian Institute; by the Academy of Natural Sciences in Philadelphia, and at most of the other scientific centres in this country. Had Prof. Cope sent a single copy of any of his papers to these places, it would have gone on record. The fact that he withheld all his papers from these points for months after his claimed dates speaks for itself. These dates have recently been rejected by the American Philosophical Society, where the papers were finally published, and there is now little doubt that they will meet the same fate at the hands of other scientific authorities.

III.

Prof. Cope wisely refrains from offering any explanation of the antedating of seven of his papers in the "Proceedings of the American Philosophical Society," Vol. xii. As the facts in this case are beyond question, I leave Prof. Cope to settle this point with the Society itself, which now has the matter in charge, as well as several other of this author's similar "errors," as I have charitably called them. It is important to bear in mind, in this connection, that these wrong dates, as well as the many others I have pointed out in Prof. Cope's work, are *all in his favor*, so that, assuming them to be errors, the law of chances has evidently made an exception for his especial benefit. An unfortunate dilemma likewise here presents itself, viz:—If these numerous mistakes and erroneous dates which abound in Prof. Cope's papers are merely blunders, his work is worthless from its unreliability; if they are not unintentional, Prof. Cope must assume the full responsibility of them.

IV.

In regard to his Report in "Nature," of the meetings of the American Philosophical Society, it is sufficient to say that Prof. Cope's attempted explanation (p. 296) does not meet the case at all. This report was entirely false, as I have shown (p. 307). When Prof. Cope was called upon before the above Society to explain this, he stated that the dates were taken from the table of contents of the Proceedings, an explanation at once disproved by a reference to the table itself. His present explanation is totally different, and is in itself absurd, as a comparison of the note referred to with the report at once shows. Prof. Cope here, and in a recent number of "Nature" (Vol. viii, p. 34), characteris-

tically leaves the impression that he is not the author of the report; when both his own admission before the Philosophical Society, and the internal evidence in the report, have placed this authorship beyond a reasonable doubt. "*Mens conscia recti*" indeed!

Professor Cope's "table of nomenclature" is only surpassed in ingenuity of construction by his certificate No. 3; and for direct misstatements is without a parallel in his whole explanation. Everything in the column devoted to his own work is wrong. The *Lefalophodon* note, on which he now claims the date of Aug. 19th, was merely an unintelligible telegram of no scientific value whatever, and it was not printed until after that date, and not distributed before November, when Prof. Cope returned from the West, and learned at the rooms of the American Philosophical Society that it had not been published. *Tinoceras*, although not published until Aug. 19th, was printed several days earlier. The statement that no species of this genus was described Aug. 19, 1872, is wholly untrue, since *Tinoceras anceps* dates back more than a year ("American Journal of Science," ii, p. 35), as the Professor knows perfectly well. A reference to the literature of the *Dinocerata* will correct several other gross mistakes in this table.

The only satisfactory evidence Prof. Cope has adduced in favor of the publication of any of his papers before Oct. 29, 1872, is a single newspaper item (p. 297) of no scientific authority. Even here his ruling passion shows itself, as he has antedated this item a whole year!

The question of priority, therefore, stands as follows: —

1st. If mere printing is to be regarded as publication, my papers relating to *Tinoceras*, as well as the others, were published before any of the dates claimed by Prof. Cope.

2d. If distribution of separate copies among naturalists interested in the subject decides the question, my papers antedate his in every case by more than a month.

3d. If appearance in a scientific journal is essential to publication, all my articles were published more than three months before any of his.

Prof. Cope's concluding remarks about fossil birds and reptiles were entirely uncalled for, as they have nothing to do with the present discussion. His reference to *Meleagris altus* Marsh was

especially unfortunate, as in this case he had endeavored to secure priority by sharp practice, and failed (Amer. Jour. of Sci., iv, p. 260). For this kind of sharp practice in science, Prof. Cope is almost as well known as he is for the number and magnitude of his blunders. His next statement about his services in describing certain fossil reptiles is not true. The value of his aid in this department of palæontology may be judged from the fact that after a long study of this group he did not even know the position of the quadrate bone;* mistook the ilium for the ischium;† and after investigating a very perfect specimen for months, he placed the *head on the end of the tail*, and restored the animal in this position as the type of a new order, *Streptosauria!*‡

The present controversy was forced upon me by Prof. Cope's misstatements and mistakes, which I had borne for years in silence, if not with equanimity. My part of the discussion ends, I trust, with this article. Prof. Cope's errors, if not his misstatements, will, I fear, continue to invite correction, but these, like his blunders, are hydra-headed, and life is really too short to spend valuable time in such an ungracious task, especially as in the present case Prof. Cope has not even returned thanks for the correction of nearly half a hundred errors.

To sum up, briefly, the results of this discussion, it is now plainly evident that:—

1st. Prof. Cope committed a series of blunders in his papers on the *Dinocerata*, which are without a parallel in the annals of science.

2d. He has failed to make it even probable that a single one of his doubtful papers was *published* at the date claimed.

3d. He deliberately withheld his papers from every naturalist to whom they would be of immediate service.

4th. In refusing to explain the antedating of seven of his papers in the "Proceedings of the American Philosophical Society," he virtually assumes the responsibility of it.

5th. His report in "Nature" of the meetings of this society was false, and his two attempts at explanation carry with them their own refutation.

Yale College, May 26, 1873.

* American Journal of Science, iii, p. 448. † Same Vol., p. 452.

‡ Proceedings Boston Society of Natural History, 1869, p. 265 and Transactions American Philosophical Society, Vol. xiv, p. 40, 1st ed.